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The Telephone as a Monopoly

Impressive figures of one of the most widespread public utilities are those presented in the annual report of the American Telephone & Telegraph Company, abstracted in this issue. With one telephone station for each dozen inhabitants of the United States, this company controls perhaps two-thirds of the stations and three-fourths of the wire used in telephone service in this country. To an extent much greater than is true with any other electrical utility telephone service approaches 100 per cent effectiveness, and hence efficiency, in proportion to the degree that it is monopolistic. It is recognition of this fact that is the basis of the present agitation for government ownership and operation of the telephones. That to telephone users should be given the power through the government to determine the adequacy of the service rendered and the reasonableness of the charges therefor no one can doubt. Experience with privately owned public utilities operated under commission control justifies us in asserting that much better results for the country as a whole can be obtained through private operation under strict governmental regulation than through governmental ownership and operation under the complex political influences existing in the United States.

Compensation for Bond Salesmanship

One of the most vital problems confronting the electrical industry is purely financial—that of raising month by month the enormous amount of new capital required for construction and expansion of all kinds. For maintaining a rate of increase of 20 per cent per annum the industry is indebted, first and foremost, to the men who are finding the capital that makes this expansion possible. Every year electric lines are extended into many square miles of territory where previously nothing was known of the benefits of electric service. Putting up the money for such extensions involves some risk, and, though the underwriters themselves may be familiar with the factors upon which success and failure depend, such knowledge must be shared with the investing public before the latter can become somewhat convinced of the trustworthiness of the venture. The salesman of bonds is as important a man to the industry as is the salesman of turbines. It may require much skill to sell electric service in a town of 20,000 population in a far Western state, but no less skill is required to sell in the East the bonds of the company which will call the service and the business into being. If it is equitable to receive a given percentage for handling the bonds of, say, an established railroad of which the promise-to-pay is known to be as safe as the Rock of Gibraltar, is it not equitable to receive twice as much for disposing of the securities of some frontier enterprise requiring twice as much effort to launch? Every business man will admit the full justice of according a somewhat higher rate of commission to individuals who, having shouldered the full responsibility for performing what is after all a public service, have then to spend much time and money in disposing of the bonds to the investing public. "Truly the laborer is worthy of his hire"; and the armchair executive and the bond salesman are no less laborers than the dare-devil lineman and the mining electrician.

The Late Mr. Westinghouse

Seldom does it become the duty of an engineering paper to record the death of a man so intimately associated with the profession and industry it represents as is the case with the *Electrical World* in making note in this issue of the passing away of Mr. George Westinghouse. In his death the world loses a great inventor, an indomitable advocate of sound engineering development and, most of all, a man of controlling personality, exerted always for the best interest of his fellow-men. Although a pioneer in electrical development and widely recognized as a leading manufacturer of electrical apparatus, Mr. Westinghouse's reputation as an inventor was acquired largely through the non-electrical air brake, perhaps his most valuable gift to humanity and civilization. To him more than to any one else must be attributed the introduction of the alternating-current system now employed almost universally throughout the whole world. From the point of view of engineers, no characteristic trait of the man was more prominent than that which caused him to advocate the use of a system condemned by many as being dangerous, deadly and unworthy of serious consideration. Time has served to prove to all the foresight of Mr. Westinghouse, whose career viewed in retrospect shows him to have been one of the wisest engineer-inventor-manufacturers of his generation. A financier of the highest integrity, Mr. Westinghouse's most successful methods differed so widely from those employed in banking circles that he was considered a poor financier among financiers. Death delayed his coming until these men were convinced of the soundness of Mr. Westinghouse's unusual financial policies for reorganizing the Electric company without jeopardizing the interests of its creditors, stockholders or employees. His heart was

ever in the welfare of the Electric company, even after he had been relieved of the arduous duties of the office of president of this great organization. To what extent the relinquishing of control over this product of his creative imagination was in accord with Mr. Westinghouse's personal desires the public will never know, but one cannot fail to be impressed by the fact that recognition of achievements withheld when he was most active was freely bestowed upon him in later years. As recently as December 6, 1913, we honored ourselves by recording the honor bestowed upon Mr. Westinghouse when he received the Grashof Medal in recognition of his services for the good of humanity. Contrary in many respects to the proverbial prophet, Mr. Westinghouse was best loved and appreciated by those who knew him best. Many of his lifelong friends and business associates have willingly contributed for this issue eulogistic notes characterizing the man and his career.

The Standardization of Frequencies

In an article abstracted in the Digest in this issue Mr. C. W. Stone brings to the front the fact that the time has arrived when for most purposes, if not all, sixty-cycle apparatus is far more advantageous than twenty-five-cycle equipment. At the higher frequency turbo-generators are cheaper and more compact and efficient than those for twenty-five cycles. The motors and transformers are cheaper to build and more efficient, and motors can be built with less restriction as to speed. Moreover, synchronous converters at sixty cycles are now reliable and efficient so that the never very adequate reason for adherence to the lower frequencies for converters is no longer worth mentioning. It is, of course, uneconomical to spend money for frequency-changer sets for use with twenty-five-cycle apparatus operated in most cases at a distinct disadvantage. Wherever it is inadvisable to install sixty-cycle synchronous converters in any specific case it will probably be better to use motor-generators than frequency changers plus synchronous converters. In short, for large systems for the distribution of energy such as modern electrical supply systems the advantage, in Mr. Stone's opinion, lies altogether with the sixty-cycle apparatus, and in the interest of economy there ought to be a steady effort to eliminate the less useful low-frequency machines and to utilize the standard line of the more efficient and economical apparatus.

It is against the first principles of efficiency to adopt for general electrical distribution a frequency that cannot be utilized conveniently in the lighting work which is still the backbone of the profit in electrical energy supply. It is quite unnecessary to retain the low frequency even for conversion into direct current because sixty-cycle converters are perfectly feasible machines at the present time, and even if they were not available it would often be desirable to use cascade converters or motor-generators for the sake of the better control of the voltage. Even for motor service work alone, such as is represented by railway loads at the present time, all conditions of service can be well met without being forced to use a frequency that is inapplicable or seriously disadvantageous in lighting service.

Central-Station Industry Growth

The Bureau of the Census is instructed under act of Congress to collect and publish the statistics of various industries, including those of public utilities in the central-station field, street railways, telephones and telegraphs. These statistics are collected in five year periods, overlapping those of manufacturing, which of course include electrical apparatus. The latest periods are 1902, 1907 and 1912, so that we are already almost midway to the next period of 1917. The figures are now available for 1912, and their presentation in these pages last week affords a basis for a great deal of interesting comment, discussion and forecast, as well as "hindcast." We find for 1912 a gross income of $302,000,000 from "straight" central stations. This is supplemented by nearly $37,000,000 from electric railway systems furnishing electric-lighting service. The total for 1912 would therefore be about $340,000,000. The growth for ten years has been at the rate of over 25 per cent per annum. This would bring the income in 1913 up to about $425,000,000. The estimate in these pages at the beginning of the year was that it might possibly reach $450,000,000, which will pass as a fairly good guess. The estimate of income in these pages for street and electric railways in 1913 was $650,000,000. The reported figures for 1912 are $585,000,000, not including electric service on steam railways. The average rate of increase on street railways has been nearly 14 per cent for ten years, so that it looks as though the figures would stand, and be even a little bit under the mark.

Some little doubt may be entertained as to the Census Bureau figures for incandescent lamps. With most large companies or systems that must be now a matter of guesswork. As to arc lamps, the figures are doubtless true, and they show how vast a change has been effected in the last five years. At the same time, the statistics do not take note of the heavier energy consumption of the flaming-arc units now on the circuits.

The extraordinary effect of the use of water-power on the general returns would suggest that some kind of classification of plant is necessary, or else that some differentiation is desirable as to the big bulk customer and the small individual consumer. The fact that electric service has steadily grown cheaper in face of "higher cost of living" has not yet been driven home into the public consciousness.

Many interesting facts develop from the general table, corroborated or intensified by those of the territorial groups. It will be noted, for instance, that while the gross income has increased 252 per cent in ten years, the income from all other sources has increased 899 per cent, and this does not include motor service. The

table gives the increase in horse-power of motors as 843 per cent. The obvious inference is that with modern central stations the "diversity-factor" plays more and more an important part, and that lighting, once the chief load, has sunk to a position of secondary or tertiary significance as far as size is concerned. It has all worked to a common end in the lowering of rates and the universality of service.

Artificial Daylight

In a lecture delivered before the Franklin Institute by Dr. Herbert E. Ives an interesting exhibit was made of artificial daylight obtained from a Welsbach burner as a source. The particularly important feature of this work is the fact that the absorbing medium depended upon to give the color balance is a single sheet of tinted glass. Formerly screens for artificial daylight have, we believe, been compound, either of glass or of stained films. Any and all of these devices are able to give a good simulation of daylight color values for the respective illuminants for which they are designed. Obviously a light that is weak in the blue just where daylight is strong must have its other components greatly reduced in order to reach the proper color balance, and the more blue in the source the easier on the whole it is to produce a daylight screen. It is reported that similar experiments made with the nitrogen lamp have shown practically the gain in efficiency due to increase in radiation in the blue that would be indicated by theory, albeit even the nitrogen lamp is considerably weaker in blue than ordinary daylight.

In the present state of affairs no particular difficulty seems to be encountered in obtaining artificial daylight if one really knows what is wanted. There is much more difficulty in determining what is to be considered standard daylight than in reproducing it once its composition is known. For certain purposes "north light"—that is, light which on a clear day is exceptionally rich in blue—is much in favor, but it should be pointed out that it is by no means certain that such light is desirable for all purposes. Certain delicate shades are not properly shown in a north light, just as blues shift under illumination of a yellower tone. It is very easy to exaggerate either effect in screening lamps, so that although we now have the possibility of good artificial daylight it is important to know whether, having obtained it, it is quite the thing really wanted. The definition of what is to be considered normal white light is a rather difficult matter, and the time is now ripe for its serious consideration by physicists and illuminating engineers. The values heretofore obtained for so-called white in terms of the three primary colors differ very materially among themselves, and actual daylight passes through a rather wide scale of color values which succeed each other so gradually that one quite fails to take account of them. It is when one color scheme is suddenly contrasted with another, as in passing from daylight to lamplight or back again, that the differences become strikingly apparent. Moreover, some colored fabrics are not intended to produce their normal color effect by daylight, but rather by artificial light, so that a still greater element of uncertainty is introduced. While, therefore, we are now able to reproduce daylight artificially, the details of its best practical application still remain to be worked out

The Glare from Paper

A practical study of glare from paper in its quantitative aspects is outlined in this issue by Prof. L. R. Ingersoll, who has made use of the familiar principle that paper, in common with most other substances, polarizes that portion of the light which is specularly reflected from it. With most surfaces polarization is fairly complete at a certain critical angle. The proportion of polarized light reflected at this or any other angle can readily be determined by the use of some one of the forms of polarimeter, a convenient and ingenious type of which Professor Ingersoll describes. Such an instrument provides a rather handier way of investigating the specular reflection from paper than is found in the ordinary photometric processes for determining this quantity, and we hope that it will be freely used in practice to obtain data for the improvement of printing papers.

The tables of results reported by Professor Ingersoll are very striking particularly in showing the great difficulty of avoiding specular reflection and the effect of calendering on the amount of the surface reflection. As Professor Ingersoll shows, the varying texture of the paper produces astonishing variations in the amount of glare, the coated book papers being particularly high in specular reflection. Colored papers have almost as much surface gloss as uncolored ones so that the proportion of specularly reflected light, on the whole, is large in them. Some little experimenting will undoubtedly be necessary in order to determine from the measured percentage of specular reflection by this or any other process the working qualities of the paper as viewed by the printer. It seems now to be fairly well understood that even halftone cuts can be used successfully on paper with a much less glossy surface than was once supposed to be necessary, even without particular attention to the character of the blocks. When the photo-engraver understands better how to make cuts for printing on unglazed paper the probability is that results of a very high class can be obtained without any particular difficulty, except perhaps in the case of some reproductions with intricate detail for which plate paper may still have to be used to secure the best results. However, the gain from the reduction of glare from paper is so marked in its relation to comfort in reading that publishers should make a serious effort to utilize matte-finished paper, and the *Electrical World* is now experimenting with this end in view. Our thanks and those of other journals are due Professor Ingersoll for his investigations, which seem destined to lead to improvement in printing papers from the viewpoint of legibility.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Marconi Patents Held Valid

In a decision handed down on March 18 in the United States District Court in Brooklyn, by Judge Van Vechten Veeder, three important radio-telegraph patents owned by the Marconi Wireless Telegraph Company were held valid, namely, No. 11,913, issued to Dr. William Marconi on July 13, 1897; No. 609,154, issued to Sir Oliver Lodge on Aug. 16, 1898, and No. 763,772, issued to Dr. William Marconi on June 18, 1904. It was held that the National Electric Signaling Company had infringed the two patents of later dates, and not the earlier Marconi patent, the scope of which is somewhat limited. It is understood that an appeal will be taken to a higher court.

Washington Section of E. V. A. Organized

A Washington (D. C.) section of the Electric Vehicle Association of America was organized March 12 and will be conducted along the same lines as the parent association.

Mr. F. W. Smith, New York president of the Electric Vehicle Association of America, was present at the Washington meeting and addressed the members of the new section, reminding them of the wonderful possibilities for the electric vehicle in the Capital City and its environs. He pointed out that the electric vehicle is no longer in an experimental stage, and that from an engineering standpoint the battery-driven car is setting the pace for simplicity of design and construction.

The following officers of the local section were elected: Chairman, Mr. E. S. Marlow, manager commercial department Potomac Electric Power Company, Washington; vice-chairman, Mr. R. Bruce Emerson, of Emerson & Orme, and secretary-treasurer, Mr. C. M. Marsh, commercial engineer of the Potomac Electric Power Company.

Water-Power Control Sought by New York State

The policy of having the State develop its own water-power resources, instead of leaving that work to private enterprise, is recommended in the report of the Velte committee submitted to the New York State Legislature on March 12.

A bill was also introduced by Senator Velte designed to repeal laws incorporating the Niagara County Irrigation & Water Supply Company and other Niagara power corporations, in accordance with the recommendations of the committee.

The creation of a State waterways commission is the purpose of a bill introduced by Senator Peckham. The commission would consist of Henry W. Hill, president of the New York State Waterways Commission; John Claflin, president of the New York Chamber f Commerce; George S. Swain, president of the American Society of Civil Engineers, and Robert H. Treman, president of the New York State Bankers' Association. The salary of the president would be $5,000, and that of each of the other members $3,000, the bill carrying an appropriation of $42,000.

It is specified that the commission shall make an investigation and report to the Legislature of 1915 what legislation is advisable to conserve the waters of the State and provide for utilizing the flow of the rivers.

N. E. L. A. Convention Arrangements

The thirty-seventh convention of the National Electric Light Association will be held at Philadelphia June 1, 2, 3, 4 and 5, 1914. The headquarters of the association will be at the Bellevue-Stratford Hotel. All the regular sessions will be held in three commodious meeting rooms on the ballroom floor, where more than 2000 members can participate conveniently in the exercises at one time and can, within a minute, go from one section to another. The exhibition committee, on behalf of the Class D members, has made arrangements for the occupancy of the entire roof garden of the hotel and has planned an exhibit of rare beauty and interest in a setting of unequaled artistic attractiveness. The garden has a wide view over the whole city and has also a separate restaurant of its own. Thus the entire convention will be housed in one building, while the facilities are such as to minimize any crowding or difficulty of circulation. The offices of the secretary, the hotel, transportation and local registration and information committees and the main registration bureau and the counters for the distribution and deposit of convention reports and papers will all be on the ballroom floor, within immediate access of every meeting hall. Telephonic bulletins will keep each room and the offices advised as to the progress of business in the various sections.

Work of the Convention

The work of the convention will begin on Tuesday morning, June 2, and will close on Friday morning, June 5. A very full program has already been arranged in the general, executive, technical, commercial, accounting and hydroelectric sections and sessions, but it is proposed to limit mere reading of papers and reports as much as possible and to develop discussion. There will be several parallel sessions during Tuesday, Wednesday and Thursday, culminating in a most important general and executive meeting on Friday morning.

Entertainment

The convention will open on Monday night, June 1, with the annual reception to the president in the grand ballroom. With this and the public policy meeting of Wednesday night special features of interest will be associated. On Wednesday afternoon the annual baseball game will be played for the trophy cup, and there is already keen interest among the competing company section teams. At the close of the convention a great rejuvenation will be held by the Jovian Order, whose membership is very large in the ranks of the N. E. L. A. Other general entertainment for ladies is being arranged for during the week by the special entertain-

ment committee of the convention committee, of which announcement will be made in due course. Opportunities will also be provided for visiting the numerous historic spots in which Philadelphia is so rich.

Registration

For some years past it has been the practice of the association to issue in advance a set of separate registration cards for attendance, papers, hotel accommodation, transportation, etc. A change in method is being attempted this year in combining these cards in triplicate form, which the member fills up and returns, once for all, to the association office, stating his plans, preferences, arrangements and other details. The set of cards will be issued with a supplemental circular about the middle of April. The registration of the large membership in the Philadelphia district will be in the hands of a local registration committee.

Hotel Accommodations and Transportation

Philadelphia is fortunately very well provided with excellent hotels, and the hotel committee, of which Mr. A. H. Manwaring, of Philadelphia, is chairman, will see that requests for reservations shall receive due and proper attention. A reception committee will assist at the railway depots and hotels. In the event that the desired reservation cannot be secured at the hotel selected by the member, the committee will place a reservation with some other hotel offering similar accommodation and rates.

The transportation committee, Mr. G. W. Elliott chairman, has practically completed arrangements for the movement of members of the association from all sections of the country to Philadelphia. Special trains are being arranged for from Chicago, one over the Pennsylvania Railroad, leaving probably in the evening and making the daylight run between Pittsburgh and Philadelphia, arriving at the convention city in the early afternoon. The committee is also trying to arrange for a special train from Chicago over the Lake Shore Railroad, leaving in the morning and taking on at Toledo members from Detroit and other adjacent points, and also at Cleveland the large delegation that usually goes from that large electrical center. The train will reach Buffalo late in the evening and take up Buffalo and Canadian travel. Another special is being arranged for from the Southeastern section, and much is expected for the success of this train, as all the members in that section are bending every effort to make it a representative movement. Definite decision has not yet been arrived at regarding the Pacific Coast members. It may be found necessary to run a special from San Francisco. The Kansas City and St. Louis contingents will move to Chicago and there feed the two specials from that point as before described. This will also apply to St. Paul, Minneapolis and Northwestern points. On account of the short run between New York and Philadelphia and the excellent train service between these two cities, it has been decided not to attempt to arrange for special trains. This will also apply to Boston, the New England delegates preferring to go to New York and from there to Philadelphia. The transportation committee and the railroads between New York and Philadelphia will be in close touch all the time to insure sufficient train equipment on the days when the members are going and returning from the convention.

A strong general convention committee has been organized under the chairmanship of Mr. W. C. L. Eglin, vice-president of the Philadelphia Electric Company and past-president of the association. The foregoing announcements are an outline of its work and plans and of what is proposed by its sub-committees.

Census Returns on the Electric Railways of the United States

The Bureau of the Census has given out preliminary figures of its forthcoming quinquennial report of the electric railways of the continental United States. The statistics relate to the years ended Dec. 31 for 1912 and 1907 and June 30 for 1902. The totals, as intimated in the *Electrical World* last week, include electric-lighting plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads or of railways under construction during the census year which had not begun operations.

The figures as presented for the continental United States show general gains for the decade 1902-1912. The number of operating companies increased from 817 in 1902 to 975 in 1912, or 19 per cent. There were 41,065 miles of track in 1912, as compared with 22,577 in 1902, or an increase of 82 per cent. The persons employed numbered 282,461 in 1912, as compared with 140,769 in 1902, or an increase of 101 per cent. The revenue passengers carried in 1912 numbered 9,545,554,667, as compared with 4,774,211,904 in 1902, or an increase of 100 per cent. The gross income in 1912 amounted to $585,930,517, as compared with $250,504,-

CENSUS DATA ON THE ELECTRIC RAILWAYS OF THE UNITED STATES

	1912	1907	1902	Per Cent of Increase, 1902-1912
Number of companies	1,260	1,236	987	27.7
Operating	975	945	817	19.3
Lessor	285	291	170	67.6
Miles of line	30,437.86	25,547.19	16,645.34	82.9
Miles of single track†	41,064.82	34,381.51	22,576.99	81.9
Cars, number	94,016	83,641	66,784	40.8
Passenger	76,162	70,016	60,290	26.3
All other	17,854	13,625	6,494	174.9
Electric locomotives	277	117	3	.....
Persons employed	282,461	‡221,429	‡140,769	100.7
Salaried employees	23,271	11,700	7,128	226.5
Wage earners (average number)	¶259,190	209,729	133,641	93.9
Power:				
Horse-power, total	3,665,051	2,476,479	1,349,211	171.6
Steam and gas engines (including turbines)—				
Number	2,312	2,552	2,351	*—1.7
Horse-power	3,193,744	2,384,518	1,300,058	145.7
Waterwheels—				
Number	383	228	159	140.9
Horse-power	471,307	91,961	49,153	858.9
Kw capacity of dynamos	2,508,066	1,723,416	898,362	179.2
Output of stations, kw-hr.	6,052,699,008	4,759,130,100	2,261,484,397	167.6
Current purchased, kw-hr	2,967,318,781	§	§	.....
Passengers carried	12,135,341,716	9,533,080,766	5,836,615,296	107.9
Revenue	9,545,554,667	7,441,114,508	4,774,211,904	99.9
Transfer	2,423,918,024	1,995,658,101	1,062,403,392	128.1
Free	165,869,025	96,308,157	§	.....
Car mileage (passenger, express, freight, etc.)	1,921,620,074	1,617,731,300	1,144,430,466	67.9
Condensed income account of operating companies:				
Gross income	$585,930,517	**$429,744,254	**$250,504,627	133.9
Operating revenues	$567,511,704	$418,187,858	$247,553,999	129.2
Transportation revenues	$520,184,773	$390,276,347	$235,997,005	120.4
Non-transportation revenues††	$47,326,931	$27,911,511	$11,556,994	309.5
Income from other sources	$18,418,813	$11,556,396	$2,950,628	524.2
Operating expenses	$332,896,356	$251,309,252	$142,312,597	133.9
Gross income less operating expenses	$253,034,161	$178,435,002	$108,192,030	133.9
Deductions from income (taxes and fixed charges)	$191,123,408	$138,094,716	$77,595,053	146.3
Net income	$61,910,753	$40,340,286	$30,596,977	102.3
Dividends (operating companies)	$51,650,117	$26,454,732	$15,882,110	225.2
Surplus	$10,260,636	$13,885,554	$14,714,867	*—30.3

*A minus sign denotes decrease.
†Includes track lying outside the United States, namely, 1912, 31.91 miles; 1907, 27.52 miles, and 1902, 4.20 miles, and exclusive of track not operated.
‡For 939 companies in 1907 and for 797 companies in 1902.
¶Number employed Sept. 16, 1912.
§Figures not available.
**For 939 companies in 1907 and for 799 companies in 1902.
††Income from sale of energy included: In 1912, $36,500,030; in 1907, $20,093,302; in 1902 $7,703,574.

627 in 1902, or an increase of 134 per cent. The operating expenses amounted to $332,896,356 in 1912, as compared with $142,312,597 in 1902, or an increase of 134 per cent. The total horse-power of the power plants was 3,665,051 in 1912, as compared with 1,349,211 in 1902, or an increase of 172 per cent. The horse-power of the waterwheels increased from 49,153 in 1902 to 471,307 in 1912, or 859 per cent. The output of stations amounted to 6,052,699,008 kw-hr. in 1912, as compared with 2,261,484,397 in 1902, or an increase of 168 per cent. The energy purchased in 1912 amounted to 2,967,318,781 kw-hr., the figures for 1902 not being available.

Government Aid and Additional Water Rights Wanted by Ontario Hydro Commission

Resolutions calling upon the Canadian government to assist the Hydro-Electric Radial Railway scheme to the extent of $6,400 per mile bonuses, asking that the plans for the furtherance of the deep waterways projects be favorably acted upon, and praying the Hon. Adam Beck to reject the Canadian Commissionership if it is given him, that he may remain in Ontario to continue his work on behalf of the people, were passed by unanimous votes at the Hydro-Electric Radial field day convention held in London, Ontario, March 5. Delegates were in attendance from every municipality in the Province west of Guelph and all were in accord with the resolutions offered. Enthusiasm for Hydro radials was most pronounced, especially when the Hon. Adam Beck delivered his address, forecasting a degree of success for the radial projects not even exceeded by the Hydro power project.

It appears certain that a very large deputation will be prepared to go to Ottawa to ask for the $6,400 per mile bonus. This deputation will be merged with that of the Waterways Association, which asks for the immediate deepening of the Welland Canal, of the Sault Ste. Marie Canal, of the St. Lawrence Canals, and in the same connection for the preservation to public ownership of the water rights on those waters. One of the resolutions embodied a clause asking that the necessary procedure by which to secure an additional supply of power be sanctioned. Mr. Beck pointed out that there is now but 6000 cu. ft. a second of water available at Niagara Falls for the development of power and announced that tenders have been received from a number of development companies asking for these rights. One of them—the most liberal, he said—claims to be able to develop by an advanced method upward of 100,000 hp. The right is asked to export only 40 per cent of this, whereas existing companies are exporting 50 per cent. This concern, however, asks the government to pay $12 per hp-year, as against $9 paid to the Ontario Power Company. The Hydro-Electric Power Commission has gone into the matter and has learned that by diverting the water to the Welland Canal and taking advantage of certain facilities thereby obtainable 224,000 hp can be developed, and at a much smaller cost. The commission's contract with the Ontario Power Company calls for 100,000 hp, but because of the fact that 90,000 hp of this will be in use before the end of 1915 immediate action must be taken to augment the supply.

Mr. Beck stated that the economic questions of the day would be solved to a large degree by the construction of Hydro-Electric radials. Bonuses, he said, are given freely to private corporations, and there should be no difficulty in the way of subsidizing public enterprises that are to be honestly and economically conducted.

Death of Westinghouse

"The history of this organization from the time of its creation by Mr. Westinghouse to its present magnitude is the story of the genius, wisdom, courage and foresight which placed him among the foremost men of his age.

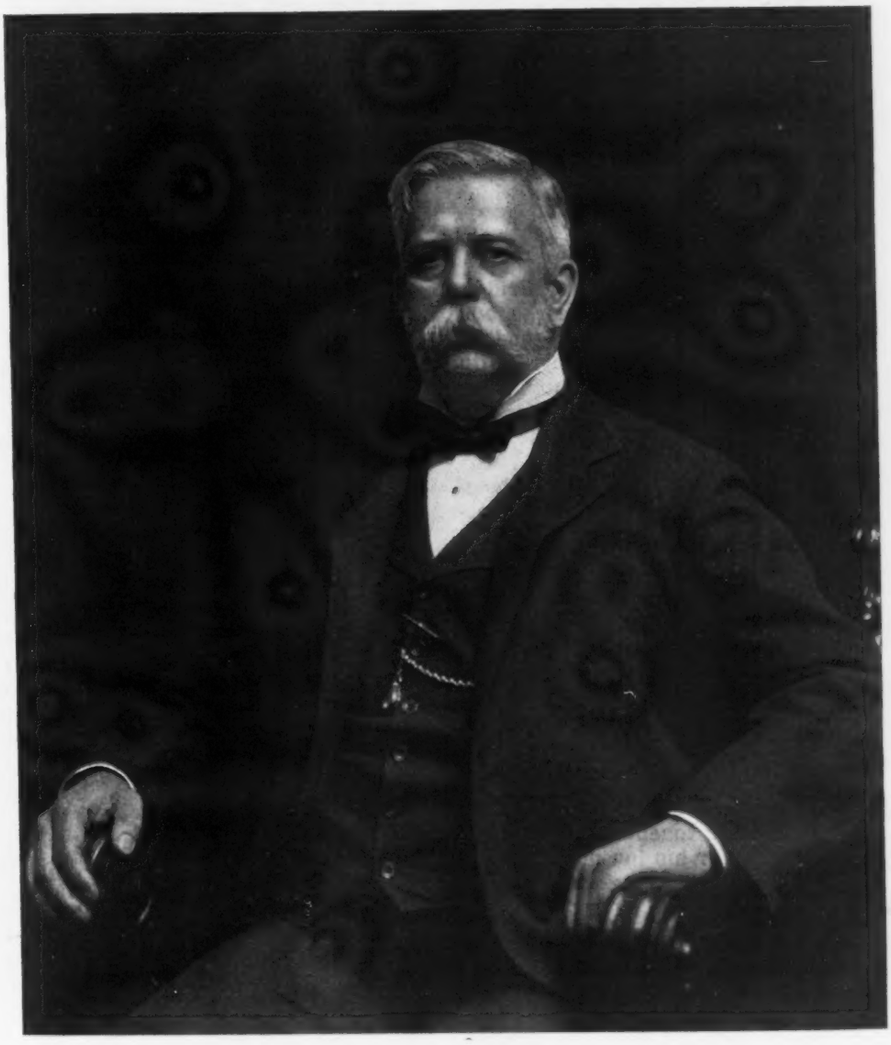
"By his death a high-minded and inspiring leader of men has been taken away. There has been a great public loss.

"It is with sorrow that the board registers this last sad memorial among the chronicles of the company built by him, and orders it engrossed and forwarded to his family."

Thus did the directors of the Westinghouse Electric & Manufacturing Company at a special meeting held on Tuesday place on record their estimate of the founder of the company, George Westinghouse, who died on March 12 after last week's issue of the *Electrical World* had gone to press. The great inventor and captain of industry succumbed to heart disease at his residence in New York in his sixty-eighth year. This ailment first manifested itself about fifteen months ago and necessitated his withdrawal almost wholly from business affairs. However, his mental alertness and activity remained unimpaired to the end.

At his funeral, which took place from the Fifth Avenue Presbyterian Church, New York, last Saturday, a notable gathering witnessed the last rites. Representatives of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the National Electric Light Association, the New York Electrical Society and numerous other professional bodies were in attendance. The honorary pallbearers were Messrs. Charles Francis Adams, Horace F. Andrews, Charles J. Canda, Charles Crane, president Crane Company, Chicago; George Gibbs, electrical engineer Pennsylvania Railroad; T. A. Gillespie, early associated with Mr. Westinghouse in installing first service of natural gas in Pittsburgh; J. M. Guffey, of Pittsburgh; J. H. Gantt, vice-president American Society of Mechanical Engineers; W. S. Hawk, of Hawk & Wetherbee; E. M. Herr, president Westinghouse Electric & Manufacturing Company; H. T. Herr, vice-president and general manager Westinghouse Machine Company; A. L. Humphrey, vice-president and general manager Westinghouse Air Brake Company; Alexander C. Humphreys, president Stevens Institute; T. B. Kerr, Walter M. McFarland, vice-president Babcock & Wilcox Company; J. R. McGinley, president Chicago Pneumatic Tool Company; William H. Newman, chairman of the board New York Central Railroad; George T. Oliver, United States Senator, Pittsburgh; Col. H. G. Prout, vice-president Union Switch & Signal Company, Pittsburgh; Samuel Rea, president Pennsylvania Railroad; L. B. Stillwell, former president American Institute of Electrical Engineers; Charles A. Terry, vice-president Westinghouse Electric & Manufacturing Company; E. B. Thomas, president Lehigh Valley Railroad; G. E. Tripp, chairman of the board Westinghouse Electric & Manufacturing Company; W. D. Uptegraff, director Westinghouse Air Brake Company; S. T. Wellman, Wellman, Seaver, Morgan Company, Cleveland; Daniel Willard, president Baltimore & Ohio Railroad; F. V. Underwood, president Erie Railroad; W. H. Marshall, president American Locomotive Company; Admiral Robert E. Peary, and the Rev. Dr. D. Wortman, Orange, N. J., the pastor of the church in Schenectady attended by Mr. and Mrs. Westinghouse at the time of their marriage and up to the time of their departure for Pittsburgh in 1867.

Forty-seven veteran employees of the Westinghouse companies came from Pittsburgh to pay their respects



Geo. Westinghouse

to their dead chief, and the 25,000 men in the Westinghouse industries around Pittsburgh suspended work on Saturday as a tribute to his memory. A memorial service was also held in the Welfare Building at Wilmerding, Pa., which was attended by about 2000 people. A Westinghouse Memorial Association was formed in Pittsburgh Monday the object of which is to raise a fund by popular subscription for the erection of a monument that will be one of Pennsylvania's greatest memorials.

It was stated that the death of Mr. Westinghouse will not cause any great change in the policy or operation of the Westinghouse industries. A system which he devised several years ago for their continuance will go into effect. For three years he had been limiting his activities and placing greater responsibilities upon trusted associates. These same men had handled the affairs of the industries during his frequent business trips to Europe and will now form a Board of Trustees, headed by his brother, Mr. H. H. Westinghouse, which will have full management over the estate.

Career of Westinghouse

George Westinghouse was born at Central Bridge, N. Y., Oct. 6, 1846. His parents were George and Emeline Vedder Westinghouse. Mr. Westinghouse's father was also an inventor and in 1856 removed with his family to Schenectady, N. Y., where he established the Schenectady Agricultural Works, which is still standing directly opposite the great works of the General Electric Company at Schenectady. George Westinghouse was one of five sons, only one of whom, Herman H. Westinghouse, is now living. The boy attended the public schools of the town and spent his leisure moments in his father's machine shop. Before he was fifteen years old he invented and built a rotary engine. In June, 1863, although not seventeen, young Westinghouse enlisted in the Twelfth New York National Guard and shortly after joined the Sixteenth New York Cavalry. He was honorably discharged in November of the following year and a month later accepted an appointment as third assistant engineer in the United States Navy.

At the close of the civil war Mr. Westinghouse entered Union College, where he remained until the end of his sophomore year, leaving to enter upon active life and to find a wider scope for his inventive genius. In 1865 he invented a device for replacing railroad cars on the track, which was manufactured by the Bessemer Steel Works at Troy, N. Y. His first patent for an air brake was awarded a few years after, on April 13, 1869, and the Westinghouse Air Brake Company was formed on July 20 of that year. He invented the automatic feature of the brake and in 1886 was awarded a patent for a quick-action brake. In 1863 Mr. Westinghouse became interested in the operation of railway signals and switches by compressed air and developed and patented the system now manufactured by the Union Switch & Signal Company.

Formation of the Electric Company

In 1886 the Westinghouse Electric Company was formed for the manufacture of lamps and electric lighting apparatus, Mr. Westinghouse having become interested in the subject. The business rapidly developed and in 1889 and 1890 the company absorbed the United States Electric Lighting Company and the Consolidated Electric Light Company. In 1891 all these properties were reorganized into the Westinghouse Electric & Manufacturing Company, which owns extensive works at East Pittsburgh, Pa. While the company was still growing Mr. Westinghouse had the foresight to gather about him such able and talented engineers as William Stanley, Nikola Tesla, O. B. Shallenberger and others in the development of alternating-current machinery. Mr. Westinghouse rendered an invaluable service to the industry when in spite of strong opposition he succeeded in introducing the alternating-current system of distribution. The direct-current system was then used exclusively in this country. In 1885 Mr. Westinghouse sent the late Franklin Pope, then on the consulting staff of the Westinghouse company, to England to purchase the American rights to the invention of Messrs. Goulard and Gibbs, two British electricians who experimented with what they called alternating currents. Within a month after Mr. Pope's return Mr. Westinghouse had set up a laboratory to develop the Goulard-Gibbs invention commercially. From that moment the real growth and application of electricity to lighting, manufacturing and transportation may be said to date. He backed Tesla financially and with shop facilities in developing the induction motor, and built the first ten great dynamos for Niagara Falls. The alternating current which Mr. Westinghouse fought into universal recognition has alone made possible long-distance transmission of energy and the development of hydroelectric power far remote from the point of its utilization.

After the panic of 1907 the Westinghouse Electric & Manufacturing Company went into the hands of receivers and Mr. Westinghouse lost control of the company. However, the recent reorganization of the company was due to the adoption of a plan which he originated and which he carried through successfully with full protection to creditors and stockholders and without interruption to the work of the thousands of employees.

Almost akin to his work for electric transmission of energy was his system for controlling natural gas and conveying it through pipe lines for long distances, thereby establishing the practicability of utilizing natural gas as fuel in homes, mills and factories. Mr. Westinghouse also took a foremost part in the development of gas engines and in adapting steam turbines to electric driving. Besides his genius as an inventor, Mr. Westinghouse was well known as an organizer and financier. The Sawyer-Man incandescent lamp, the Nernst lamp and the Cooper Hewitt mercury vapor lamp were all put on a commercial basis by Mr. Westinghouse.

One of his notable triumphs was in obtaining, in 1892, the service contract for lighting the World's Columbian Exposition at Chicago. The Chicago World's Fair was the first of the great international expositions where all the lighting and the operation of all machinery (outside of Machinery Hall, where steam engines, steam turbines, steam pumps, etc., were exhibited) was done by means of electrical energy. More things that were then novel and interesting were done by electrical means at the Chicago World's Fair than at any of the great expositions before or since. Electrical accomplishment was comparatively new then, and it was recognized that the advertising value of furnishing the electrical energy for the buildings and grounds would be very great. The only plan considered was the erection of a service plant in Machinery Hall. The idea that the energy might be purchased from a central-station organization did not, perhaps, occur to anybody; at any rate, it was not seriously advanced. The year 1892 witnessed the consolidation of the two great rivals of the Westinghouse company, the Edison General and the Thomson-Houston companies, into the General Electric Company. Both of the two great electrical organizations remaining were very anxious to get the contract for lighting the World's Fair. Apparently the General Electric Company, controlling the very important Edison incandescent-lamp patents, which had been upheld by the courts, had the

better chance. But Mr. Westinghouse entered the lists personally, made a number of visits to Chicago, and conducted such a hot fight that he secured the contract. The original specifications were dated Feb. 22, 1892, but the bids received were rejected, and new specifications were issued. About 90,000 16-cp incandescent lamps were required. Bids were opened on May 16, 1892, and the contract for supplying, installing and operating the plant for the period of the fair was awarded to the Westinghouse Electric & Manufacturing Company for $5.25 per lamp. Alternating current was used, and the 1000-hp generators in the service plant were looked on with awe as veritable giants in dynamo-electric machinery. All of the primary circuits except one were laid underground. The largest transformer was rated for 200 lamps. But the most interesting feature of the job was the lamp used. It was the Westinghouse or Sawyer-Man "stopper" lamp, provided with a ground-glass stopper to permit the renewing of the filament, which was operated in an attenuated atmosphere of nitrogen. Iron leading-in wires were substituted for platinum, and the lamp was operated at 105 volts. This lamp never came into general use, but it did not infringe the Edison patents, apparently, and it served its purpose. The upshot of the whole contest and the World's Fair undertaking was greatly to increase the prestige of Mr. Westinghouse's company.

To Mr. Westinghouse was given the honorary degree of Doctor of Philosophy by Union College in 1890, and in 1906 the Königliche Technische Hochschule of Berlin bestowed upon him the degree of Doctor of Engineering. His decorations comprised the Legion of Honor of France, Royal Crown of Italy, and Leopold of Belgium. He was the second recipient of the John Fritz medal and was awarded the Edison Medal by the American Institute of Electrical Engineers in 1912. On behalf of the engineering profession of Germany the American Society of Mechanical Engineers presented him with the Grashof Medal last December. Mr. Westinghouse was an honorary member of the American Society of Mechanical Engineers, of which he was also a past-president, the National Electric Light Association and the American Association for the Advancement of Science. He was president of a large number of corporations having an aggregate capital of over $100,000,000, the largest of which are the Westinghouse Air Brake Company, the Westinghouse Machine Company and the Union Switch & Signal Company. He was also the head of about a dozen companies abroad, the largest of which are in London, Manchester and Havre. Mr. Westinghouse was married Aug. 8, 1867, at Brooklyn, N. Y., to Marguerite Erskine Walker, who with one son, George Westinghouse, Jr., survives him.

Tributes of Former Associates

It is not in one profession alone that the memory of Westinghouse will live. Kelvin said of him: "George Westinghouse is in character and achievement one of the great men of our time." Physically he was a big man; he also was great in character and mind. Interesting sidelights on his brilliant career contributed by men formerly associated with him and published herewith show how highly he was esteemed, and what was lost in his passing away.

From William Stanley

I can only add my appreciation of the great qualities of leadership that Mr. Westinghouse possessed. His strong, vigorous purpose, his wonderful grasp of the opportunities of life and his high courage overcame all obstacles and were of inestimable value to the electrical engineering profession and the world.

Great Barrington, Mass. WILLIAM STANLEY.

From Peter Cooper Hewitt

In George Westinghouse the world has suffered the loss of a great and valued citizen and much should be said in honor of his accomplishments and advancement of modern industry. Essentially an American, he had universal reputation and respect.

The vast and divers works which he pioneered give an idea of his force and energy and illustrate dominant characteristics. Every effort of his genius was expended for humanity in advancing the arts of civilization. As the problems involved in nature's secrets unfolded themselves before him he strained every effort and means at his disposal to turn their use to the benefit of mankind.

He appreciated the enormous danger to humanity that accompanies the harnessing of vast forces of nature for public use, and by his foresight and skill prevented disasters which might conceivably have been of enormous extent.

The memory of George Westinghouse will live through his appreciation of nature's forces and his love of mankind.

New York. PETER COOPER HEWITT.

From Nikola Tesla

The first impressions are those to which we cling most in later life. I like to think of George Westinghouse as he appeared to me in 1888, when I saw him for the first time. The tremendous potential energy of the man had only in part taken kinetic form, but even to a superficial observer the latent force was manifest. A powerful frame, well proportioned, with every joint in working order, an eye as clear as a crystal, a quick and springy step—he presented a rare example of health and strength. Like a lion in a forest, he breathed deep and with delight the smoky air of his factories. Though past forty then, he still had the enthusiasm of youth. Always smiling, affable and polite, he stood in marked contrast to the rough and ready men I met. Not one word which would have been objectionable, not a gesture which might have offended—one could imagine him as moving in the atmosphere of a court, so perfect was his bearing in manner and speech. And yet no fiercer adversary than Westinghouse could have been found when he was aroused. An athlete in ordinary life, he was transformed into a giant when confronted with difficulties which seemed unsurmountable. He enjoyed the struggle and never lost confidence. When others would give up in despair he triumphed. Had he been transferred to another planet with everything against him he would have worked out his salvation. His equipment was such as to make him win easily a position of captain among captains, leader among leaders. His was a wonderful career filled with remarkable achievements. He gave to the world a number of valuable inventions and improvements, created new industries, advanced the mechanical and electrical arts and improved in many ways the conditions of modern life. He was a great pioneer and builder whose work was of far-reaching effect on his time and whose name will live long in the memory of men.

New York. NIKOLA TESLA.

From Calvin W. Rice

Of the many remarkable qualities that come to one's mind in thinking of Mr. Westinghouse, none stands out more prominently than those which characterize him in his home life.

While Mr. Westinghouse had a tremendous capacity

for work and power of concentration and always carried an atmosphere of one whose work was his first desire, it was evident to those who knew him intimately that it was not the work itself but the desire to accomplish results. Nowhere was this shown more clearly than in his relations to the routine of his well-ordered home. He followed with precision the program for the day but was so gentle and gracious withal that one yielded as a matter of course to his plans.

When separated from Mrs. Westinghouse, as he usually was for two or three days of each week, it was his uniform habit to hold a daily conversation over the telephone. It made no difference how far separated or how busy Mr. Westinghouse may have been, that greeting was exchanged not only at a definite hour, but with fondness and thought of every detail of Mrs. Westinghouse's comfort. Another beautiful feature of the conversation was the never-failing inquiry on the part of both for the guests of the other and the sending of messages of greeting for the guests.

Mr. Westinghouse had the most perfect balance between strength and gentleness, both physical and mental, of anyone I ever knew. In fact, one might say he had the gentleness of strength under complete control.

His sense of dignity was always present, and one was conscious also that Mr. Westinghouse knew and was satisfied with his own superiority of equipment and mastery of any situation and that his self-respect was absolute. His successes in life under great difficulties were the result not only of masterly genius but of supreme confidence.

New York. CALVIN W. RICE.

From Walter M. McFarland

As I review my association with Mr. Westinghouse for almost twenty years, the dominant thought that comes to me is the way in which his greatness impressed itself upon all about him. One could not be with him and know him without feeling that he was in the presence of one of the world's great and wonderful personalities.

This was not because of any peculiarity of manner, for he was singularly unaffected and simple in his dealings with everybody, and one of the most approachable of men. You knew of all the wonderful things that he had done, and you realized that he was different from the average man of ability.

The mental qualities which brought about the success of his wonderful career were numerous and diversified, and it was the fact that he possessed them all which differentiated him from those who possessed only a few. Imagination, organization, executive ability, foresight, courage, tenacity of purpose and cheerfulness were the great qualities that were all his. It would be difficult to say which of these contributed most to his success, but my personal association and knowledge of his history would lead me to place tenacity of purpose first, and then courage and foresight.

The wonderful success of the air brake, which was the foundation of his fortune, and by which he is known to most people, has rather masked the still more wonderful history of the successful introduction of alternating-current machinery and the organization and development of the great electric company bearing his name. If a writer like Kipling had all the facts of his life, the history of his electrical work would prove one of the most fascinating stories that have ever been written.

The high quality of technical work which Mr. Westinghouse conducted led to the employment of an unusually large number of talented men. Many of these are still in his companies, while a very large number have gone out into other electrical and engineering enterprises. It is safe to say that no man ever inspired his subordinates and associates with more affectionate admiration and respect, and, as one of those who, after serving him for many years, have recently been in touch with him only as personal friends, I wish to add my tribute of respect and admiration for his wonderful work and my gratitude for his many personal kindnesses to me. It is a great privilege to have worked for such a man, and to have been associated with him as one of his officers, and it is a still greater privilege to have been honored with his personal friendship.

New York City. W. M. MCFARLAND.

From Charles A. Terry

A prominent business man recently made this statement: "To say that George Westinghouse was a man of a generation would be inadequate; he was a man of centuries." It is interesting to consider what were the qualities of a man of whom this could so justly be said. That he was a great inventor is a fact of world-wide recognition, but there have been other great inventors. We look then for further qualities, and it is in these, which rival even his unusual inventive genius, that we find the character of his greatness. Prominent among these qualities those who knew him well would place his powerful intellect, his tremendous will power, his indomitable courage, all being different manifestations of his strong personality. His quick insight into the verities of any problem enabled him to arrive rapidly at conclusions, and when convinced of the justice and feasibility of the end to be attained and satisfied as to the course to pursue he trained the full force of his will upon its accomplishment. Large obstacles served only to intensify his interest in the pursuit. Small obstacles made no impression. Threatened defeat, which would often dishearten his associates, called into play only that dauntless courage which was so much a part of his being that he seemed not to recognize it as a quality distinct in itself. But even this persistence and this courage alone would not have availed to develop the numerous industries bearing his name nor to construct the acres of buildings in which the thousands of employees find congenial occupation. Back of these forces there was a far-sighted apprehension of not merely the possibilities but the certainties of future scientific and industrial development. A powerful scientific imagination gave to his opinion almost the character of accurate prophecy. He had, besides, a remarkable quickness of perception and clearness of vision unhampered by the limitations of the average observer. These, backed by sound judgment and practical sense, made it possible for him to turn into material benefit to the world the varied inventions which found their origin in his fertile brain.

Combined with these qualities of genius, will force and far-sightedness, there was a personal charm which won for him the admiration and affection of those who labored with and for him, as well as of those who, in the struggle of commercial progress, were his business competitors. His winning smile, his cordial grasp of the hand, evidenced a heart warm in its regard for mankind, loyal in friendship and gentle in affection.

The life and deeds of the man who was gifted with these qualities and who utilized them to their fullest extent have been an inspiration to those living in his own generation and will be an object of admiration through generations to come.

New York. CHARLES A. TERRY.

From L. B. Stillwell

The dominating characteristics of George Westinghouse were intellectual vigor, dauntless courage and tireless energy. During an acquaintance extending

over more than twenty-seven years the impression of his ability and energy, first formed when I had the good fortune to enter his employ at Pittsburgh in October, 1886, has been deepened and strengthened. The ten years of my connection with his interests covered a period of extraordinary activity and progress in the development and commercial application of alternating currents, and during this period, at first as assistant electrician and later as chief electrical engineer of the electric company, I was thrown into very intimate professional and personal relations with him.

For the last seventeen years, as the representative of other interests having large dealings with the Westinghouse Electric & Manufacturing Company and with other companies established by Mr. Westinghouse, my observation has been from a different point of view; but during all these years and from both points of view the conviction has grown that in ability and energy no captain of industry in our time has excelled him and few, if any, have been his equals.

The wide range and great variety of the products of the manufacturing companies which he organized and which in no small measure were based upon his own personal inventions testify to his remarkable versatility in the field of applied mechanics and differentiate him strikingly from the majority of his leading contemporaries in commerce and industry. He is most widely known as the inventor of the air brake, but it should not be forgotten that the introduction in this country and the development and wide industrial application of the alternating-current system for transmitting and distributing electricity were due primarily to his foresight, courage and personal efforts. He was the central figure also in the utilization on a large scale of the natural-gas resources of western Pennsylvania and adjacent states, while for his work in development of the automatic-block-signal system the traveling public owes him a debt only less than that which it owes for the air brake.

From the outstart his influence upon the young men associated with him was extraordinary. His lieutenants inevitably partook of his own bouyant hopefulness and his determination to find the solution of the many problems encountered in his development work.

In character and habits of life Mr. Westinghouse set a high standard, which has influenced hundreds of men connected with his various enterprises. He never preached, save by example, but his preaching was remarkably effective. He never smoked, and I cannot recall that I ever saw him drink even a glass of wine at his own table, although both wines and tobacco were provided for his guests. There are hundreds of men whose standards of living are better for their association with George Westinghouse, and there are thousands of men, women and children whose material prosperity and happiness are due in no small measure to his creative and constructive work. Civilized communities everywhere have benefited by his inventions, his organizing ability, his courage and his tireless work to an extent which it would not be easy to measure.

New York. LEWIS B. STILLWELL.

From E. M. Herr

A great man has passed away. In the death of George Westinghouse we, his friends, lose and the world loses (for his work was world-wide) a man not of a generation merely but a man in a century. Men with the many brilliant attainments of Mr. Westinghouse are so rare that several generations are likely to pass before one is met with.

It is as an inventor that he was best known, and in the exercise of his remarkable inventive ability he found his greatest pleasure. His inventions were not only great in numbers, but many of them were of epoch-making importance to humanity.

Great and famous as he was as an inventor, to those closely associated with him he was even more remarkable for his splendid courage, quickness of perception and far-seeing and accurate judgment of future needs and tendencies in the world's progress. These characteristics made him always an optimist and, combined with his indomitable will and ability as an organizer, enabled him to build up in about thirty-five years of his business career the large aggregation of manufacturing industries with which his name is associated and which are established not only in many states in this country but also in Canada, England, France, Italy, Austria and Russia. These industries together require an investment of about $200,000,000 and employ upward of 60,000 people.

The profits of these great corporations which came to Mr. Westinghouse were used only in very small part for his personal needs, his interest in the acquisition of money being almost wholly to enable him to exploit and develop, for the good of humanity, more of the inventions of himself and others.

He was always open-minded and quick to see good in the work of other inventors, and much of the progress and development made by his great industries was due to his appreciation and acquisition of the valuable inventions of others, using his own great ability to perfect and adapt them to commercial needs.

In dealing with others he was eminently fair and liberal, but independent and courageous in his own work, never hesitating to assume the entire responsibility for anything he undertook, impatient of interference and rarely accepting or adopting suggestions from his engineers or associates.

His courage was of the highest kind. He would fight to the last ditch and, no matter what the odds against him, was never known to surrender or even accept a truce. On the other hand, his nature was most kindly and considerate.

With unfailing courtesy and kindliness he prosecuted his work but always insisted on the best efforts of his employees, his own unflagging zeal and great energy setting a pace which few could follow and none ever exceed.

Mr. Westinghouse lived very simply, was plain and unostentatious in his manner, very approachable, of a keen sense of humor and a most engaging personality. His kindly courtesy and consideration for all endeared him to his employees and inspired in them a spirit of great loyalty and affection for their chief.

Pittsburgh, Pa. E. M. HERR.

Threaten Reduction to 3-Cent Maximum Rate at Cleveland

A mandatory ordinance now pending before the City Council of Cleveland, Ohio, will, if passed, reduce the Cleveland Electric Illuminating Company's maximum rate to residence customers to 3 cents per kw-hr. The ordinance has passed its first reading in the Council.

Residence customers are now served under a sliding scale of prices, the maximum being 10 cents per kw-hr and the average rate earned under this schedule being 6.25 cents per kw-hr. The average lighting bill in Cleveland homes to-day is $1.91 a month. At present the company has no established minimum bill. The general impression seems to prevail among members of the Cleveland company's staff that the rate is confiscatory and will not be sanctioned by the Ohio Public Service Commission.

Annual Report of the Bell Telephone System

The continued growth of the Bell Telephone system, its earnings and expenses and general financial prosperity, its attitude as to government ownership, its agreement with the Department of Justice, the sale of its Western Union holdings and its relation with the general public, are all set forth in detail in the annual report of the American Telephone & Telegraph Company just issued.

President Theodore N. Vail has something very definite to say in regard to the government ownership of telephones, and his frank discussion of this question is one of the most interesting features as well as the most voluminous part of the report.

Government Ownership and Operation

In summing up the attitude of the company toward this subject, Mr. Vail says:

"Our opposition to government operation and ownership is not based on pecuniary, partisan, prejudiced or personal reasons. It is because of our interest in the upbuilding of a great public utility and its preservation."

He states that the common impression that the Postmaster-General has made a report favoring the acquisition of the wire lines is erroneous. It is not a departmental report, he says, but merely the conclusions of three officials of the Post Office Department, transmitted without comment by the Postmaster-General.

As to possible government purchase, Mr. Vail quotes Congressman Lewis, the Congressional exponent of government ownership, to the effect that there is no water in the Bell capitalization, and urges the stockholders not to be induced to part with their holdings through fear of confiscation.

The advantages of one telephone system are clearly set forth, as are the differences between the exact technical knowledge required for operation and the judicial ability necessary for regulation.

"Government administration," the report says, "is more or less a game of politics, and while with government operation it may sometimes be possible to have efficiency, it will always be impossible to have economy.

"The government-owned European telephone plants, notwithstanding the low price of foreign labor, are carried at a much higher cost than those of the Bell system, and yet every one of them uses the Bell system as a model. The book value of the plant of the Bell system per station is less than 60 per cent that of Belgium, less than 75 per cent that of Austria, about 85 per cent that of Germany, Great Britain and Switzerland, and all of these are government-owned."

Mr. Vail maintains that Americans are better supplied with telephone facilities than any other people, having six times as many telephones per capita as Great Britain and thirteen times as many as France.

In showing the inability of the Post Office Department to operate the telephone business efficiently he says:

"The success of the parcel post has been set up as a reason for the government operation of the telephone and telegraph. Why it should be is hard to understand. The two services have nothing in common and are in no way comparable. The parcel post is not in any sense a new service; it has merely increased the volume of the mails by removing some limitations as to size and weight of packages mailed, and making some reduction in rates of postage for merchandise.

"It would not be a question of capacity; the experiment would be disastrous principally because the postmasters are not fitted by experience or training for the telegraph or telephone business, but also because it would be secondary to their grocery-dry-goods-notion shop, their principal business."

Another reason is that the telephone already reaches more places than there are post offices.

He concludes his remarks on this subject by saying that:

"Regulation by commissions of high standing composed of individuals of ability and integrity, and good impartial judgment, is the greatest protection to the public interests as against private exactions that ever was devised. Its effectiveness depends upon 'the standing with the public of the commission as a whole and the commissioners as individuals.' "

Growth of the Bell System

During the past year subscribers' telephone stations have increased until now there are 8,133,017, a gain of 676,943. These stations reach 70,000 localities, or 10,000 more than the number of post offices. The total wire mileage is 16,111,011, of which 92 per cent is copper.

More than half the wire mileage is underground, the total underground plant representing a cost of $181,500,000.

The number of daily telephone connections showed a growth of nearly 2,000,000, reaching an average of 27,237,000 a day. Europe has only two-fifths of the telephone traffic of the United States.

The extension of the telephone plant during the year amounted to $54,871,856, making a total for fourteen years of $646,915,200. According to present estimates, the construction for the current year will cost in the neighborhood of $56,000,000, of which the local resources of the companies will supply $25,000,000.

Large reserves have been made for maintenance, reconstruction and depreciation, and a steady improvement of service has been achieved.

The report says:

"The gross revenue in 1913 of the Bell system—not including the connected independent companies—was $215,600,000, an increase of over $16,000,000 over last year. Of this, operation consumed $75,400,000; taxes, $11,300,000, or 1½ per cent on the outstanding capital obligations; current maintenance, $32,500,000, and provision for depreciation, $37,700,000.

"The surplus available for charges, etc., was $58,700,000, of which $16,700,000 was paid in interest and over $30,300,000 was paid in dividends.

"The total capitalization, including inter-company items and duplications but excluding reacquired securities of the companies of the Bell system, is $1,390,242,470. Of this, $620,127,086 is owned and in the treasury of the companies of the Bell system. The capital stock, bonds and notes payable outstanding in the hands of the public at the close of the year were $770,115,384. If to this be added the current accounts payable, $26,471,681, the total outstanding obligations of every kind were $796,587,065, as against which there were liquid assets, cash and current accounts receivable of $72,237,885, leaving $724,349,180 as the net permanent capital obligations of the whole system outstanding in the hands of the public."

In the case of the associated companies, excluding the American Telephone & Telegraph Company, particular attention is called to the percentage of net earnings and of dividend and interest disbursements to total plant and other assets: Net earnings to plant and other assets, 5.69 per cent; dividends and interest to plant and other assets, 4.92 per cent. In other words, the property employed earned less than 6 per cent per annum, and the dividends and interest paid were less than 5 per cent upon the value of the property, which could not be considered unreasonable.

Taken by itself the American Telephone & Telegraph Company shows net earnings of $40,576,746.19, an increase of $2,669,101.93 over 1912. The total outstanding capital stock and bonds were $504,207,300, which represents payments into the treasury of over $24,500,000 more than the par value of the capital obligations.

The number of shareholders, 55,983, showed an increase of 5,686 during the year.

Engineering

At the beginning of 1914 there were in the Bell system 12,000,000 telephone receivers and transmitters owned by the Bell company. Of these practically none were made prior to 1902, and of all the instruments now in service the average are less than five years old.

During the year 1913 further advances in the art of loading and balancing underground circuits have so greatly improved the intermediate apparatus that it is now possible to talk satisfactorily by underground wires from Boston to Washington, in part through types of cable formerly suitable for short-haul distances only. These short-haul cables make up 47 per cent of the total cable in the line.

An exhaustive study of the New York-Denver line during the last year has shown that these improvements in transmission through underground wires are also applicable to overhead lines. Plans are now making for the rearrangement of the New York-Denver circuit. When this is accomplished the telephone transmission between New York and Denver will be equal to that now given between points about 200 miles apart and will insure satisfactory talk from the Atlantic to the Pacific and in due course bring all points in the United States within telephonic speaking distance of each other.

It has frequently been asserted that the Bell system did not employ automatic switchboards because of patents controlled by others. The report states that "the Bell company owns or has rights in every United States patent and patent application which would be necessary to operate its system upon the so-called automatic plan —which is not automatic for the subscriber as the subscriber does all the manipulation in the making of a connection. As yet it has not been demonstrated that the automatic system would give as good and dependable service as we now render to the public, when used in connection with the extensive and comprehensive suburban and interurban telephone system of the Bell company." At headquarters the Bell system has a force of 550 engineers and scientists engaged on studies of these subjects.

Legal

In describing the work of the legal department, the co-operation of the Bell system with the Interstate Commerce Commission is shown, and the correspondence is given setting forth the agreement with the Department of Justice.

Mr. Vail shows how the disposal of some $30,000,000 of Western Union stock was brought about so as to separate completely the two companies. During the three years of association the gross revenue of the Western Union increased 45 per cent, the wages of operators were increased 55 per cent, and large sums were set aside for revenue and reconstruction.

The report says that the financial condition of the Western Union, with some $15,000,000 net of liquid assets, was never better.

Employees' Benefits

The report shows that, under the pensions, disability benefits and insurance plan, in 16,054 cases employees of the Bell companies had participated in the benefits and the payments have aggregated more than $1,000,000.

Public Service Commission News

Indiana Commission

A ruling of the Indiana Public Service Commission last week on the petition of the Fort Wayne & Northern Indiana Traction Company is interesting to electric lighting companies. The traction company seeks to establish lighting service at Lagro, Ind., on its interurban line between Fort Wayne and Lafayette. The Town Council gave the company a franchise. Under the Indiana law, the company did not know whether the commission's approval was needed for the ratification of the franchise. The question was put up to the commission, and it held, without prejudicing possible change in its ruling on similar cases, that it had no authority to approve or disapprove such a situation. In case the company desires to surrender the franchise later, or in case a petition regarding rates or some other factor should be presented to the commission simultaneously with a similar situation, it is possible the utility law would allow the commission to approve or disapprove the granting of the franchise.

Illinois Commission

Mr. Charles N. Hebner has been appointed secretary of the State Public Utilities Commission of Illinois. The salary attached to the position by law is $5,000 a year. Mr. Hebner is thirty-seven years of age and has had practical experience as an accountant in public-utility work, having been employed by the Chicago Railways Company in that capacity under Mr. John Z. Murphy, now electrical engineer of the Chicago Surface Lines.

Massachusetts Commission

The Gas and Electric Light Commission has authorized the Leominster Gas Light Company to issue 850 shares of additional capital stock of $100 par value for the payment of floating debt incurred in plant additions. The company petitioned for the right to issue 1250 shares, but the board refused 400 shares on the ground that "not less than $30,000 of the expenditures which were the basis of the debt on Dec. 31, 1913, represented the cost of property substituted for other property which had been abandoned rather than actual additions." "Such expenditure," says the board, "is in fact a provision against extraordinary depreciation and essentially a replacement of plant. The cost of such work is a proper charge upon income and should not be represented in additional stock."

Vermont Commission

By a vote of two to one, the Public Service Commission of Vermont on March 16 issued an order reducing the rates of the New England Telephone & Telegraph Company throughout the State by an average of about $3 per subscriber per year. Seven thousand subscribers are affected, the reduction applying to lines on which six or more parties are connected. The board finds that the existing toll rates are reasonable and does not disturb them. Chairman R. C. Bacon stated in an interview that in no instance would the earning capacity on plant valuation as fixed by the commission be reduced below 6 per cent, and that in some instances the earning capacity would be over 7 per cent. Commissioner Warner, of Vergennes, dissents on the ground that the evidence, he thinks, shows no cause for a reduction at present. It is expected that the company and affiliated local companies affected by the decision will appeal. Vice-president E. K. Hall, Boston, made a statement upon receipt of the finding to the effect that the reductions proposed by the majority of the commission would practically wipe out every dollar of net revenue now earned in the State by the telephone interests concerned.

Current News Notes

PANAMA CANAL LIGHTING TESTED.—Preparatory to making the Panama Canal ready for navigation, the first test of the electric lighting of the locks, etc., was successfully carried out March 13. The various buoys, lighthouses, range lights, etc., were also lighted along the entire course of the trans-isthmian waterway.

* * *

SAN FRANCISCO OFFICE OF THE ELECTRICAL WORLD.—A permanent Pacific Coast office of the *Electrical World* has been established in the Rialto Building, San Francisco, Cal. The editorial representative in charge will be Mr. N. A. Bowers, who has been news correspondent for this paper for the past year in the Northwest and previous to that time was associated editorially with the *Engineering Record.*

* * *

AN OVERLOADED RURAL TRANSMISSION LINE.—The manager of a transmission system which distributes energy to several large farm users was hurriedly summoned to the telephone to answer an excited call from one of his principal rural customers. "We don't seem to be gettin' as much power up this way as we should," declared the farmer. "Mebbee it's 'cause our line is overloaded," he continued; "I just noticed that the wires are all sagging."

* * *

DINNER TO HUBER.—Mr. Emil Huber-Stockar, engineer in charge for the Swiss government of the electrification of the Gothard tunnel and president of the Swiss national committee of the International Electrotechnical Commission, was a guest of honor at a dinner given at the Engineers' Club, New York City, March 13, by Mr. C. O. Mailloux, president of the American Institute of Electrical Engineers. Among those who took part in an informal discussion of railway electrification as exemplified by American and Swiss installations were Messrs. Frank J. Sprague, Lewis B. Stillwell, Charles F. Scott, Cary T. Hutchinson, Norman W. Storer, A. H. Armstrong, W. S. Murray, H. M. Hobart, George Gibbs, C. O. Mailloux and Emil Huber-Stockar.

* * *

SMALL ELECTRIC-SERVICE PLANTS IN WISCONSIN—The hamlet of Clayton, population 220, is perhaps the smallest community in Wisconsin having an independent central-station plant generating its own electricity. The Clayton Electric Company has an operating force of one man, and its generating equipment consists of a 12-hp gas engine belted to a 5-kw direct-current dynamo. The street-lighting load consists of eight incandescent lamps, and commercial lighting is given from dusk until 11 p. m. The Railroad Commission of Wisconsin reports 140 villages in Wisconsin with less than 1000 population having electric-service utilities. Of these forty-one are of less than 500 population. The total number of electric-service utilities in the State is 293. There are seventeen gas or oil-engine plants and eighty-two plants operated either wholly or in part by water-power. No less than seventy-eight cities and villages are supplied from municipal plants.

* * *

SOCIETY MEETINGS

MEETING OF MISSISSIPPI ELECTRIC ASSOCIATION.—The next annual meeting of the Mississippi Electric Association will be held at Meridian, Miss., April 27, 28 and 29. Mr. Frank J. Duffy of Natchez, Miss., is secretary-treasurer.

* * *

ANNUAL MEETING OF THE ARKANSAS ASSOCIATION.—The seventh annual convention of the Arkansas Association of Public Utility Operators will be held at Little Rock April 21 to 23. Mr. W. J. Tharp, Little Rock, Ark., is secretary of the association.

* * *

JOVIANS OF DAYTON, OHIO.—At the Dayton Club, Dayton, Ohio, March 16, Mr. S. G. McMeen, president of the Columbus Railway & Light Company, Columbus, Ohio, was scheduled to address Dayton members of the Jovian Order on the subject "The Age of Energy." A rejuvenation has also been arranged for the same place on Saturday evening, March 21.

* * *

PERFORMANCE OF ELECTRIC-TRUCK MOTORS.—At the March meeting of the Electric Vehicle Association of America, to be held March 24 at the Engineering Societies Building, New York City, Mr. T. H. Schoepf, of the Westinghouse Electric & Manufacturing Company, will present a paper on "The Performance Characteristics of Electric Motors and Their Influence on the Operation of Electric Trucks."

* * *

A WEEK OF IOWA CONVENTIONS.—Three Iowa conventions will be held in Cedar Rapids in the week beginning April 19. The Iowa Electrical Contractors' Association will hold its first annual meeting in the city named on April 21 and 22; the Iowa Electrical Association, of which Mr. A. L. Dodd, of Charles City, is president, and Mr. H. B. Maynard, of Waterloo, is secretary, will meet on April 22, 23 and 24, and the Iowa Street and Interurban Railway Association on April 23 and 24.

* * *

CHICAGO ELECTRIC CLUB TOLD ABOUT STEEL MAKING.—Mr. Arthur H. Young, supervisor of labor and safety for the Illinois Steel Company, Chicago, was the speaker at the luncheon of the Electric Club of Chicago on March 12. He gave an illustrated lecture on steel making, referring, among other things, to the part played by the Heroult electric furnace in the South Chicago steel works. Mr. Young is especially interested in welfare work and the "safety-first" movement, and he devoted a portion of his time to these subjects.

* * *

PITTSBURGH SECTION, I. E. S.—The April meeting of the Pittsburgh Section of the Illuminating Engineering Society will take place on Friday evening, April 17, in the auditorium of the Engineers' Society of Western Pennsylvania, 2510 Oliver Building. Mr. C. E. Stevens, of the Westinghouse Electric & Manufacturing Company, will present a paper on "The Development of Flame Carbon Arc Lamps." The address will be preceded by the usual dinner at the Fort Pitt Hotel at 6 p. m. Mr. Alan Bright, 827 Wabash Building, is secretary of the section.

* * *

CHICAGO SECTION ILLUMINATING ENGINEERING SOCIETY.—At the March 11 meeting of the Illuminating Engineering Society (Chicago Section) papers were read by Messrs. Philip Polacheck, of Milwaukee, and Charles A. Luther, of Chicago. They discussed respectively the electric and gas fixtures for a dwelling house. Mr. William A. Durgin delivered another address in his series on the fundamentals of illumination. At the April 10 meeting the section will meet jointly with the Railway Signal Association. Mr. Thomas S. Stevens, of Topeka, vice-president of the latter association, will read a paper on "The Illumination of Signals"; Dr. William Churchill, of Corning, N. Y., will contribute a paper on "Signal Lenses," and Dr. Nelson M. Black, of Milwaukee, will discourse on "The Physiology of the Eye in Relation to Signaling."

Combination Power Plant and Pumping Station

Electric service and water-works supply for Kansas City, Kan., a city of 100,000 population—Economy effected through off-peak water pumping and motor service

KANSAS CITY, Kan., has a population of about 100,000. Numbered among its residents are perhaps no millionaires, but it is the home of middle-class and working people, including factory operatives and the employees of the meat-packing establishments operating in the lowlands along the Missouri River. There are no very large stores or high buildings, the city relying for much of its business and pleasure facilities on its neighbor across the river—Kansas City, Mo. Apartment houses are almost unknown, most of the people living in detached wooden dwellings.

In 1911 $350,000 worth of bonds were issued and sold by the city for the erection of an electric plant and distributing system. The site was purchased and a building was erected in which the generator room for the electric-service station measures 60 ft. by 60 ft. and the engine room for the water-works occupies a space 120 ft. by 60 ft. The station site lies along the Missouri River in a village which was formerly known as Quindaro, Kan.

The present generating equipment of the station consists of one 1000-kva, three-phase, sixty-cycle, 2300-volt Allis-Chalmers horizontal turbo-generator operating at 3600 r.p.m. and a 500-kva unit manufactured by the same company and delivering energy at the same voltage and frequency. The turbines are set directly on the floor of the station, being supported by I-beams in the flooring and the reinforced-concrete pillars, but without the heavy monolithic foundations generally supporting units of this size. As will be seen in the foreground, space has been left vacant in the station for the installation of a 3000-kva unit which has been ordered and which it was expected would be installed before March 1. As designed, the ultimate rating of the station is 7500 kva.

Excitation for the turbo-generator units is furnished by two 37-kw motor-generator sets which supply energy to a common station exciter bus. A bank of transformers in the basement reduces the potential from 2300 volts to 440 volts for the motors of these machines.

The steam auxiliaries for this turbine equipment consist of a 5-in. by 8-in. vertical engine directly connected to centrifugal pumps for circulating water and to a "rotrex" vacuum pump. Receiving steam from the boiler room at 150 lb. pressure and 360 deg. Fahr., the turbines discharge into a Wheeler surface condenser which maintains approximately a 28-in. vacuum.

Switching and metering operations for the entire station are accomplished on a thirteen-panel marble switchboard with marine finish. This board consists of three exciter panels, one Tirrill regulator panel, three feeder panels, three generator panels, an arc-lighting

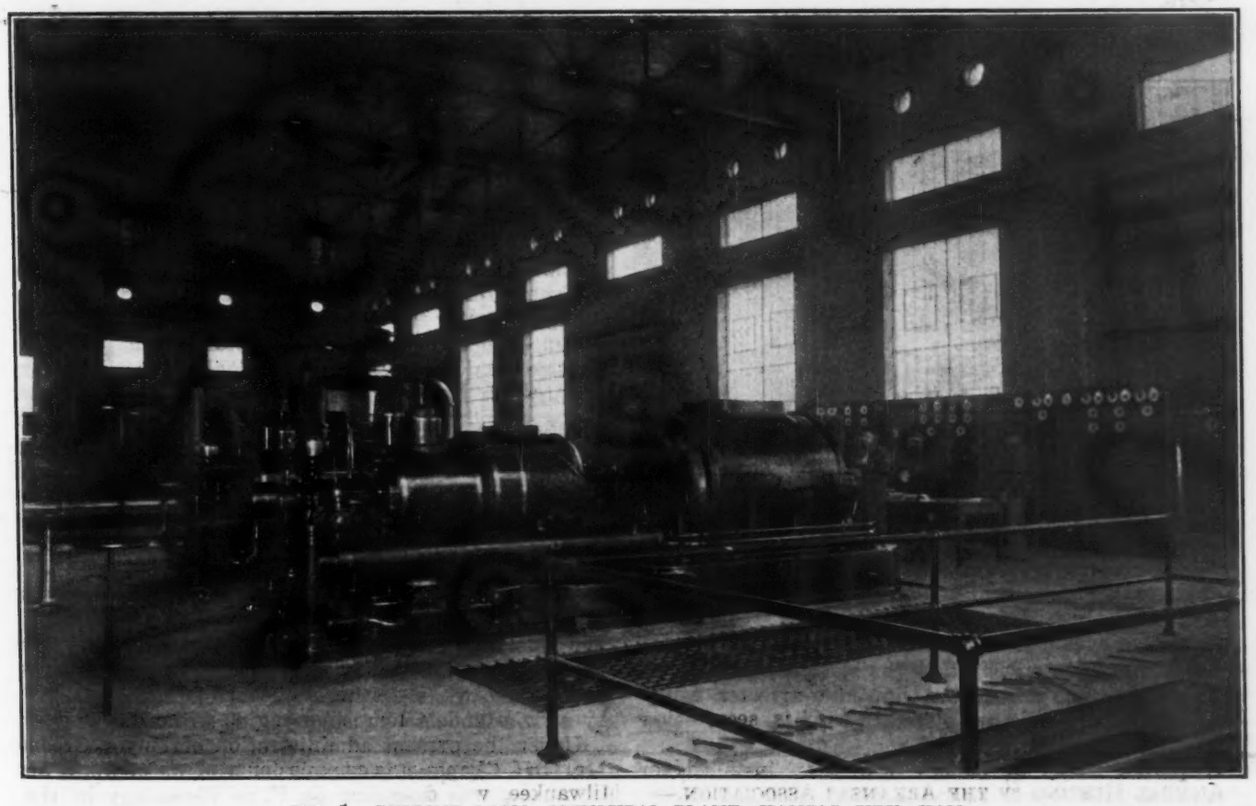


FIG. 1—TURBINE ROOM, MUNICIPAL PLANT, KANSAS CITY, KAN.

feeder panel, one panel for the exciter motors, and a 200-hp pump-motor panel. Manual remote-control apparatus has been installed on all switching panels of the board, energy for the motor-service circuits being handled at 6600 volts, while the two lighting circuits for the north and the south sides of the city are operated at 2300 volts. The power-factor indicator and synchroscope are mounted on a swinging bracket at the end of the board.

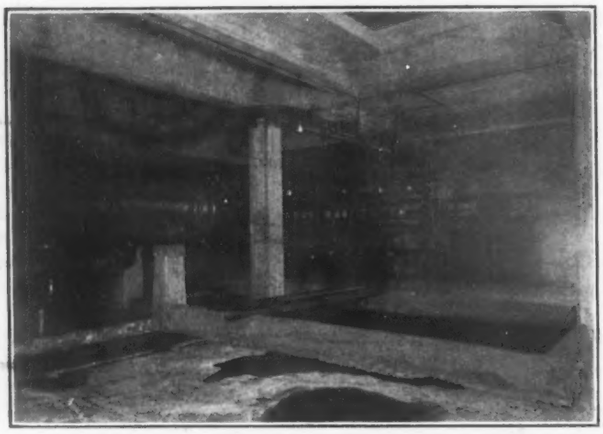


FIG. 2—WIRING AND CONDENSER EQUIPMENT IN BASEMENT

Standing behind the switchboard in the 11-ft. space which has been left between the board and the wall are six Westinghouse regulating transformers, each capable of supplying energy for 100 10-amp arc lamps. On the feeders for the lighting circuits which lead to the north and to the south ends of the city induction regulators capable of maintaining the voltage within 10 per cent above or below the normal have been installed. These units are inserted in the line with disconnecting switches on either side and with jumper wires so arranged that the regulators may be cut out of the circuit at any time for inspection or repair. No conduit has been employed in the station wiring as all high-tension bus structures, lightning-arrester equipment and choke coils are placed in the basement below and beneath the switchboard.

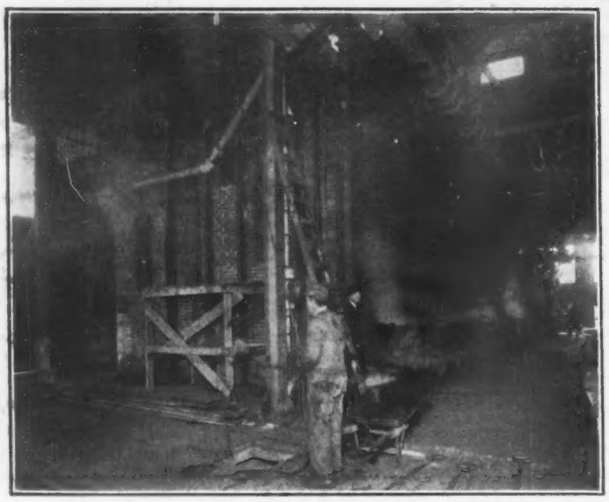


FIG. 3—BOILER-ROOM EQUIPMENT WITH UNDERFEED STOKERS

Separate banks of boilers have been installed for operating the electric-service plant and the water-works station, but either of these banks of boilers has ample rating to supply steam for both the engine-driven pumping plant and the turbines of the electric station at their present outputs. One of these sets of boilers consists of two 500-hp Bonus-Freeman units with Foster superheaters placed directly under the two 36-in. main drums. These units are set on a 6-ft. firebox and are equipped with Jones underfeed stokers. The water level is controlled by means of Williams automatic feed-water columns. All settings for these boilers are built with double walls. As auxiliary boilers there are one 300-hp Babcock & Wilcox and one 250-hp Heine unit, neither of which is equipped with a superheater. The boiler equipment ordinarily furnishing steam for the pumping plant consists of four 350-hp Heine boilers equipped with Billow's oil burners.

All steam lines from the boiler room to the engines and turbines are carried beneath the floor through underground ducts and receive a 2-in. coat of lagging with a material known as "asbestos-cell." The absence of pipe lines in the engine room is notable and gives free head room for the operation of the 20-ton crane.

Feed water for the plant is furnished by a 2000-hp Blake-Knowles feed-water heater capable of supplying 60,000 lb. of feed water an hour. The heater contains 75 sq. ft. of tray surface and is supplied with water through two boiler-feed pumps controlled by Fisher governors and having cylinders measuring respectively 12 in. by 10 in. by 14 in. and 12 in. by 14 in. by 8.5 in.

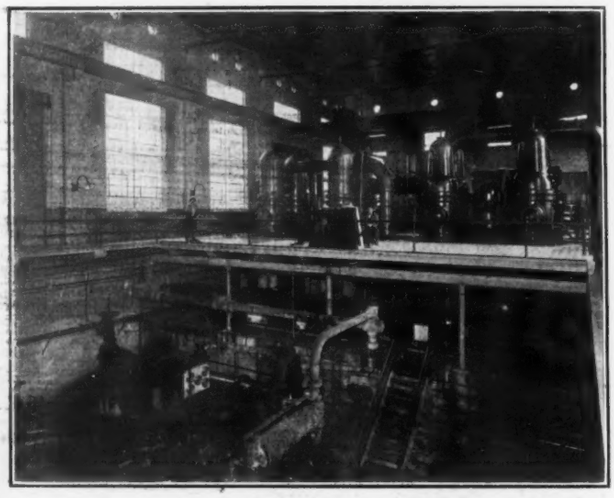


FIG. 4—PUMPING STATION OPERATED WITH POWER PLANT

Except for one 200-hp motor-driven direct-connected pump, all water for the city water-works is supplied by steam pumps. This 200-hp motor-driven pump is capable of delivering 15,000,000 gal. of water every twenty-four hours against a 38-ft. head. The remaining steam-pump equipment on the low-pressure end consists of one 15,000,000-gal. centrifugal pump directly connected to a 185-hp Corliss engine operating at 165 r.p.m. and one 8,000,000-gal. pump designed to operate against a pressure of 70 lb. per square inch but used only for low-pressure emergency service. The four high-pressure pumps operate against a pressure of 125 lb. per square inch. Of these there are two capable of delivering 12,000,000 gal. of water, one 9,000,000 gal. and another 6,000,000 gal. The two low-pressure pumps are driven by cross-compound engines of the flywheel type, while the high-pressure pumps are driven by a twin-tandem compound engine without a flywheel.

Under the present administration of Mayor Greene, Mr. L. H. Chapman is commissioner of water-works and street lighting and Mr. F. E. Williams is electrical engineer for the station.

A Means to Measure the Glaze of Paper

Outline of the theory and construction of the glarimeter, an instrument designed to provide a simple method of specifying the amount of glaze. By L. R. Ingersoll

THE subject of glare from paper is one which has been attracting ever-increasing attention of late on the part of both publisher and paper maker. The demand of the reading public for a paper of less gloss, which shall cause less strain on the eyes, has already been met by a number of magazine and textbook publishers, and it is apparently only a question of time before the use of highly calendered paper will be a rarity for ordinary reading matter. This is especially probable in view of the improvements now being made in the halftone and other reproduction processes. It becomes then very desirable to be able to specify exactly the quality of any given paper as regards its glossiness or glaze—these terms being used in the present case to mean that quality of paper which gives rise to glare—and this article describes a simple instrument which will determine this quality with precision.

It is almost obvious that a satisfactory method for measuring glaze or glossiness must be optical rather than mechanical in character, for the smoothness of a paper is by no means a safe measure of its qualities in this respect. Following a suggestion made to the writer by Mr. J. H. Thickens, formerly of the Forest Products Laboratory of the United States Department of Agriculture at Madison, Wis., but now of the Beaver Companies, Buffalo, N. Y., to the effect that it might be possible to apply polarized light to the measurement of glaze, some experiments were performed in the Forest Products Laboratory which led to the subsequent development of the instrument about to be described.

To appreciate the principles involved, it seems well first to discuss briefly the character of the light reflected from a sheet of paper. As pointed out in numerous articles and papers by Black and Vaughn, Sweet, Luckiesh and others, one may distinguish in this connection three different types of reflection. These are: Specular reflection, as from a polished surface of metal or sheet of glass, the "angle of reflection" equaling in this case the "angle of incidence"; diffuse reflection, as from a perfect matte surface, characterized by the light being sent off almost equally in all directions from the surface, and a combination of these two which might be thought of as produced by overlaying a perfect matte surface with one or more sheets of glass.

The first type, or specular reflection, causes what is known as "glare" from the paper; that is, the brilliant directly reflected light which to a certain extent dazzles the eye of the reader, causing contraction of the pupil with consequent loss of visual acuity and resulting eye strain. The diffuse reflection gives rise to the soft, evenly illuminated appearance of a matte surfaced paper, which if used with a dead-black ink gives the combination which affords greatest ease to the eye of the reader. As a matter of fact, it is the third type which is really characteristic of the reflection from paper, as the most highly glazed paper still gives a little diffuse reflection, while even as dead a surface as that of a soft blotter shows a small amount of specularly reflected light.

It is characteristic of most glass surfaces that light reflected from them at an angle of 57.5 deg. is (almost) completely plane-polarized, and the writer found by experiment that the same is true of the specularly reflected component from paper. Pieces of glazed white paper, calendered black cardboard, calendered white paper and brown solio paper all showed at this angle a polarization of the glare component estimated at more than 99 per cent complete. This instrument, then, was designed to measure the glare by determining the fraction of the light reflected from the paper at an angle of 57.5 deg. which is polarized, the illumination falling on the paper at approximately this same angle.

It must be kept in mind that it is not the absolute brilliancy of the glare spot which is to be measured, but, rather, the fraction of the total light entering the instrument which is glare; this, in the writer's opinion,

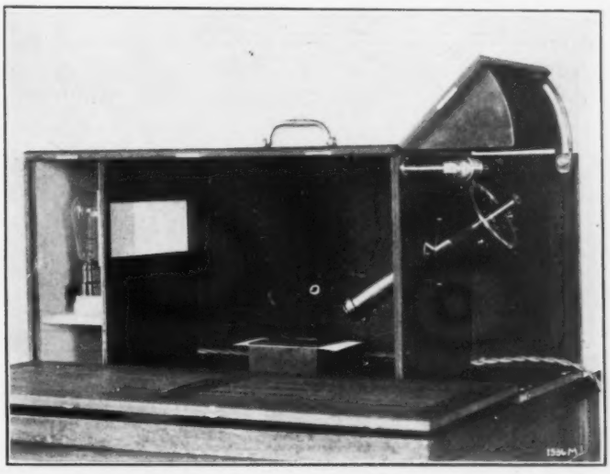


FIG. 1—INSTRUMENT USED IN MEASURING GLAZE OF PAPER

is the basis on which the matter should be discussed, as it is the relative proportion of glare and diffuse reflection which determines the readability of a given paper rather than the absolute magnitude of either.

The glare, or, as it might be called, percentage glare, as measured in this way will evidently not depend on the intensity of the illumination, but it will be greatly influenced by the shape and extent of the source of light, whether it be broad or narrow, a window or an incandescent bulb. It is necessary, then, to specify some particular type of illumination to which to refer all the measurements. For use with this instrument the illumination chosen is that from a vertical opening 3 in. square whose center is at a distance of 11⅝ in. from that of the (horizontal) test piece of paper and the line from whose center makes an angle of 57.5 deg. with the perpendicular to this sheet. The opening is covered with two thicknesses of tracing cloth, behind which is placed a tungsten lamp rated at from 40 watts to 60 watts, with reflector. It must be understood that, while the selection of this arbitrary standard of illumination is highly desirable, it is not entirely necessary, for a larger (or smaller) opening would merely

result in lowering (or raising) the fraction which represents the glaze of each specimen of paper and would not, in general, alter the order in the series in which any particular specimen came.

Description and Theory of Instrument

The instrument as designed and constructed at the Forest Products Laboratory is shown in Figs. 1 and 2. Light from the window *S*, already described, falls on the paper at *P*, this being covered with a small brass frame which keeps the sample perfectly flat and exposes only about a square inch of the surface. The construction of the part *A* is shown in Fig. 3. The light passes first through a ¼-in. diaphragm, part of the opening of which is covered with a small Nicol (Lippich) prism *N*, and the remainder with a piece of smoked glass *G* ("No. 2 smoked glass") which absorbs about one-half of the light.[1] The beam then passes through the eyepiece, which is another Nicol (Glan-Thompson) prism *M*, and thence to the eye. The prism *M* is mounted to rotate in a divided circle *C*, which reads with the aid of the vernier *V* to five minutes of arc.

On looking into the eyepiece one sees a divided field of view (Fig. 4), with the Nicol *N* below (say) and the smoked glass *G* above. The instrument is carefully adjusted so that *N* shuts off completely the specular (polarized) component of the light from the paper. A measurement is made by turning the divided circle

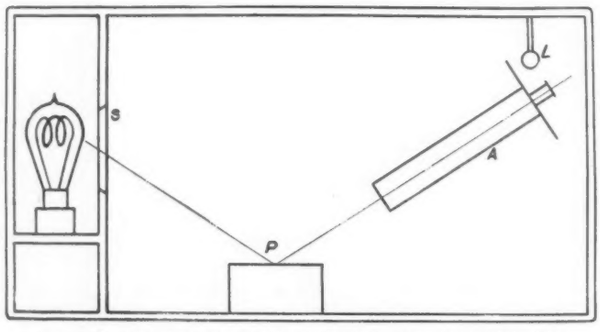


FIG. 2—DIAGRAMMATIC SECTION OF GLARIMETER

until the two fields appear of equal brilliancy, or, in other words, until the dividing line between the two fields seems to disappear. This gives a reading which enables one at once to compute the glare.

To show how this is done it will be necessary to enter into a brief mathematical discussion of the theory of the instrument. Let x represent the fraction of the light which is plane-polarized; in short, let x represent the *glare* as defined above. Also, let a represent the transmission coefficient (for light polarized in its plane) of the prism *N*, and b the transmission coefficient for the smoked glass. Then the intensities of the two beams transmitted through this part of the instrument will be proportional to $\frac{1}{2}a\,(1-x)$ from *N*, and b from *G*.

When these beams are viewed through the eyepiece prism *M*, the principal plane of which makes an angle Q, with that of *N*, these intensities are reduced to $\frac{1}{2}a\cos^2 Q(1-x)$ and $\frac{1}{2}b(1-x)+bx\sin^2 Q$, respectively.

When these two are made equal by altering the angle Q,

$$\tfrac{1}{2}\,a\cos^2 Q\,(1-x)=\tfrac{1}{2}\,b\,(1-x)+bx\sin^2 Q$$
$$=\tfrac{1}{2}\,b\,(1+x)\sin^2 Q+\tfrac{1}{2}\,b\,(1-x)\cos^2 Q \quad (1)$$

To eliminate a and b, a reading is made on unpolarized *illumination* (furnished by a sheet of soft blotting paper illuminated directly from above) in which case, since $x=0$,

$$\tfrac{1}{2}\,a\cos^2 Q'=\tfrac{1}{2}\,b,$$
$$\text{or}\quad \frac{b}{a}=\cos^2 Q' \quad (2)$$

Then one may write for (1)

$$\frac{1-x}{1+x}=\frac{\cos^2 Q'\sin^2 Q}{\cos^2 Q-\cos^2 Q'\cos^2 Q}$$

which, after a little reduction, becomes

$$\frac{1-x}{1+x}=\frac{\tan^2 Q}{\tan^2 Q'} \quad (3)$$

It appears then from equation (3) that it is possible to determine the quantity x if the two angles Q and Q' are known. As Q' may be determined once and for all and is really a constant of the instrument, this means that a determination of Q is all that is necessary, and this is measured by taking the average of a series of, say, from three to five settings with the instrument. Having determined Q, the value of x is given at once by means of a small table computed with the aid of equation (3), so the whole process of determining the glare of a particular specimen requires hardly a minute of time.

The following measurements made on some standard papers show the use of the instrument:

Paper	Per Cent Glare
Warren Standard Warrentown Olde Style	15.1
Warren Standard Warrentown Eggshell, 70-lb	18.3
Warren Standard Cameo Plate, white	19.3
Fine ground glass	21.4
Warren Standard Artogravure, white, 80-lb	22.4
Bryant Paper Company, British opaque	38.9
Warren Standard Cumberland M. F., 70-lb	43.0
Warren Standard Library Text	45.7
Bryant Paper Company, English Finish Magazine	55.8
Postal card	63.7
Glazed onion-skin, 8-lb	66.7
Warren Standard Cumberland Super	75.4
Warren Standard Superfine	79.3
Warren Standard Lustro coated book	77.5
Warren Standard Cumberland coated book, 100-lb	79.7
Warren Standard Printone, 80-lb	80.4
Warren Standard Superfine coated book	82.5
White glazed paper	90.5
Brown solio paper	99.2

One of the most interesting tests was that conducted on a series of sheets of unsized newspaper made at the Forest Products Laboratory, the sheets being originally identical but differing in finish by having been passed through the calendering rolls once, three times, five times, and so on, up to twenty-nine times, respectively. The measurements on this series are as follows:

Paper	Per Cent Glare
Uncalendered	27.7
One pinch	33.3
Three pinches	45.0
Five pinches	46.7
Seven pinches	52.8
Eleven pinches	57.0
Nineteen pinches	62.2
Twenty-nine pinches	64.8

An inspection of the results of these tests developed some striking facts. It will be noted that glazed onion-skin paper showed when tested in this fashion almost the same glare as postal card, and this was so inconsistent with the results of a hasty visual inspection—which would make the glare from the onion skin far greater than that of the postal card—that a particular study was made of this case. It was found that when the onion skin was laid perfectly flat so as to avoid wrinkles, and in several thicknesses so as to insure only reflected light, the eye estimates of glaze approximated much more nearly to the indications of the instrument. The consideration of this and one or two similar cases served finally only to strengthen the confidence in the results obtained with the instrument, and to show that

[1] This combination of Lippich prism with smoked glass might profitably be supplanted by a two-prism field of view with polarization planes at right angles. The present simple arrangement is so satisfactory, however, that it is not believed that the more complicated optical part would justify the additional expense.

casual eye observations of glaze are unreliable when the papers are of widely differing texture, for example, cardboard and thin paper.

Black and colored papers give higher glare readings than do white papers of the same finish. A little thought will serve to show that this ought to be so, since the specularly reflected light is almost independent of

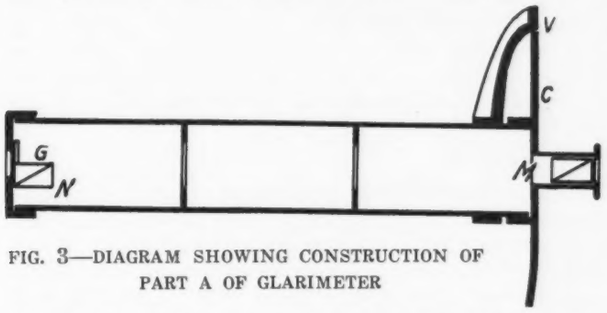


FIG. 3—DIAGRAM SHOWING CONSTRUCTION OF PART A OF GLARIMETER

the shade of the paper, while the diffusely reflected light is much less for the darker shades. The glare, as defined above, will accordingly be higher for the darker colors. Readings on solio paper of various shades gave measurements in illustration of this point.

Metal surfaces, since they do not plane-polarize light by reflection, cannot be tested with this instrument. Thus, polished silver will yield almost the same readings as does a perfect matte surface. If a type of paper exists which gives what is termed "metallic reflection," it would not be possible to measure its glare in this way either; however, the writer has never seen any such paper and doubts if any such exists. The case which would be thought to approximate most closely to this, namely, brown solio paper, still gives almost perfect polarization on reflection. In view of this fact, the writer feels that the indications of the instrument may be accepted with confidence for all classes of papers.

In conclusion, it is believed that this instrument will fill a rapidly growing need for some simple and exact means of specifying the glaze of paper. One does not need to analyze what a glare reading of 50 per cent with this instrument means; whether one can say that half the surface reflects as glass and the remainder as a matte surface—an erroneous conclusion, as a little thought will show—or that the surface is a mass of fine wrinkles, all of which reflect specularly but in so many directions that diffusion results. One neither needs nor is able to say exactly how this glare is produced, but one is able to state with positiveness that a paper which shows a 50 per cent glaze reading will give less glare than one of 60 per cent and, other things being equal, will be easier on the eye of the reader than the latter. The instrument will permit the printer to order a book paper of less than, say, 40 per cent glare, and

FIG. 4—DIAGRAM ILLUSTRATING DIVIDED VIEW ON LOOKING IN EYEPIECE

will enable the paper maker to meet this requirement with certainty; and if the net result shall be to render even the slightest service to the movement to abolish, where possible, the annoyance of glare, it will be felt that it has achieved its purpose.

Perhaps note should be made of the fact that a patent on the instrument and method has been applied for.

Report of Railway Management on Swiss Electrification

In a report lately submitted to the administrative council of the Swiss Federal States Railway by Chairman Dinkelmann of the railway management the substitution of electric for steam locomotives on the St. Gothard line is recommended in order to obtain higher speeds on grades, lower cost of locomotive maintenance and the elimination of smoke from the tunnels. This report supplements and largely confirms the report of the Swiss railway study commission commented on editorially in the *Electrical World* for March 7, 1914. It is pointed out that the lack of native fuel and the abundance of waterfalls make the electrification of Swiss railways very attractive. Water-power concessions ample for electric traction had already been acquired as part of the franchise grants of the original St. Gothard Railway Company. More recently rights were obtained to utilize the headwaters of the Binna, Rhone and Sihl Rivers.

On account of its heavy traffic and profile conditions, the Erstfeld-Bellinzona section of the St. Gothard line is well suited for initial electrification. The cost will not be excessive and the section is ample for trial purposes. Local traffic on the Erstfeld-Bellinzona line is so small that the railway management does not recommend motor-car service until the electrification can be extended to Lucerne. Only locomotives can be considered, and most of these should be adapted for hauling any kind of train. As a general rule, passenger trains should have one locomotive, and freight trains two, one acting as pusher. These machines must be capable of exerting the present maximum drawbar pull of 22,000 lb. If desired by the connecting foreign railways, the locomotives of a through express train should be capable of exerting a maximum drawbar pull of 27,500 lb. In this event ten-car trains would be possible in place of eight.

Regeneration possibilities had been carefully studied. The economy in the use of water at Ritom would be of little practical importance, and even then only for three or four months a year. The possible water saving of 10 per cent would hardly balance the higher cost of the locomotives. Regeneration is less important for a water plant than for a steam station. In no wise does electric traction on the St. Gothard line depend upon regeneration as a factor.

According to estimates, the traffic of 1918 would be 35 per cent, and that of 1928 70 per cent, greater than in 1911. The fluctuations in traffic throughout the year are very great. Thus in 1911 the daily minimum was 1,680,000 ton-km and the maximum 2,282,000 tons-km.

Generating-station sites have been chosen on opposite watersheds of the St. Gothard line, namely, Amsteg station on the north and Ritom station on the south. Fortunately, the high-water conditions for the two stations occur at different seasons. These stations would suffice for a long time for the whole of the Fifth District, in which the St. Gothard line is situated, without building a third station, which would supply enough power for many of the eastern, central and northern lines of Switzerland.

Choice of Traction Systems

The study commission had recommended single-phase operation at from 10,000 volts to 15,000 volts with fifteen cycles, not because the single-phase system is the best for any one condition, but because it is the most flexible for Swiss railroad electrification as a whole. In commenting on this decision Mr. Dinkelmann's report takes up the three systems as follows:

The direct-current system is the oldest and best tried, but it is universally agreed that high tensions are needed for supplying energy to heavy trains from an overhead wire. The necessary current could be obtained with a 1000-volt third-rail, but the management considered such a proposition speculative and so did not take it into serious consideration. On the other hand, a 3000-volt direct-current overhead line would have to be very heavy to handle the loads on the St. Gothard line, nor would it be possible to use a high direct-current voltage without sacrificing some of the good weight and speed-regulating qualities of the direct-current motor. Moreover, a high-tension direct-current line would find it very difficult or practically impossible to use directly connected storage batteries.

The adoption of the single-phase system, as recommended by the commission, has been assumed in estimating the costs of the system, because it is now clear that single-phase motors of the desired output can be built, and that the single-phase locomotive has all the speed flexibility required.

The three-phase system has certain advantages over single-phase. It is characterized by the simplicity of its traction motors, but this advantage is inseparable from very narrow speed limitations. The three-phase locomotive is superior for certain conditions, but where there are a great many profiles the running speeds would often be too high or too low for economy. Thus the Simplon locomotives, 1906 model, are limited to the approximate speeds of 35 km and 70 km an hour, while the 1907 model has four speeds, namely, 26, 35, 52 and 70 km an hour. No intermediate speeds with full tractive effort are possible. Not even a light Simplon train exceeds 70 km an hour, and if one standard speed was raised all the others would increase also. The continuous use in three-phase equipment of a maximum speed actually required for short periods only would in one case mean an increase of one-third in station generating equipment.

The rigid limitations of three-phase equipment appear in another way. Thus the 1906 type of the Simplon locomotives can be coupled to those of the 1907 type only for the common speeds of 35 km and 70 km an hour. The Giovi locomotives, which operate at 45 km and 22.5 km an hour, could not be worked economically with the Simplon machines. In general, the three-phase system does not give the desired flexibility in speed. Moreover, lost time could be made up on down grades only by sacrificing regeneration, the very quality for which three-phase is most highly praised.

If single-phase is adopted for the Erstfeld-Bellinzona line, it would be possible with little extra cost to use one potential, 15,000 volts, in some sections, and another potential, 7500 volts, in tunnels. However, the experiences with 15,000-volt suspension in the Lötschberg tunnel will serve to settle the necessity for lower voltages in tunnels.

Despite the foregoing remarks, the management does not definitely recommend the immediate adoption of single-phase, as the final decision concerning the type of propulsion equipment can be made after the hydroelectric development is fairly well advanced.

Stations and Transmission Lines

The Amsteg and Ritom stations would be fitted with 8000-hp, 7500-8000-volt, single-phase generators, driven by Pelton wheels, and connected to the contact line either directly or through step-up transformers.

The transmission potential would be 60,000 volts. The first feeding-in points would be at the two generating stations and at the Biasca substation. Up to say 1918 a 7500-volt trolley would be used and then the emf could be raised to 15,000 volts with the establishment of substations at Goeschenen, Lavorgo and Bellinzona. The transmission system would be in duplicate and each line would be proportioned to carry the power needed by all lines in the Fifth District. All substations would be tied in with each other to minimize interruptions.

The contact line would be of catenary type with transverse bridges on open sections. In the tunnels the overhead structure would be carried from supports fixed in the arched roof. Suitable precautions would be taken to localize mechanical failures. The rails would be bonded and depended upon for the return current.

Locomotives

Generally speaking, the use of the larger electric locomotives will make it possible for two such locomotives to do the work of three steam locomotives. One class of electric locomotives should be designed for a drawbar pull of 27,500 lb. and a maximum speed of 90 km (56 miles) per hour. This type would be used primarily for through passenger service but would also be available for other operation. A second class of locomotives would be designed for miscellaneous service.

Electric operation of the Erstfeld-Bellinzona section would require from thirty-six to forty-two or even more locomotives according to the increase in the number of trains following electrification.

Results Expected from Electrification

One result of electrification would be faster trains. Thus express train No. 58, which now requires 132 minutes from Erstfeld to Bellinzona, would make the trip in 114 minutes, a saving of 13 per cent. Again, the headway would be improved by saving time in going through the St. Gothard tunnel. Passenger trains which now traverse the tunnel in seventeen minutes would do so in fourteen minutes, and freight trains would cut down their time from thirty to twenty-three minutes.

In 1911 the steam locomotives of the Erstfeld-Bellinzona section ran 3,712,000 km. Electric locomotives of from 2000 lb. to 27,500 lb. drawbar pull would have to run only 2,950,000 km, a saving of 21.2 per cent. Assuming a 35 per cent increase in travel by 1918, steam locomotives would have to run nearly 5,000,000 km, compared with 3,950,000 km by electric locomotives. In 1911 the actual cost per steam-locomotive km on the Erstfeld-Bellinzona line was 1.27 francs, covering maintenance, interest and amortization of locomotives, coal, wages, stations and payments to superstructures renewal fund. If steam were used in 1918, this cost would be 5,000,000 $\times$ 1.27, or 6,350,000 francs. On the other hand, electric traction exclusive of energy expense would cost only 0.73 franc per locomotive-km.

The annual expenses in francs for electric traction would be as follows:

Traction service	2,883,500
Energy	3,104,400
Heating	100,000
Total	6,087,900

This is an approximate saving of 260,000 francs a year in comparison with steam. The superiority to steam will increase with the growth of traffic and with the extensions of lines much of whose basic expenses is comprised in the present electrification. Moreover, locomotive fuel is likely to increase in cost, and the rising wage rate will affect steam more than electric operation.

In view of the foregoing statement, an appropriation of 38,500,000 francs plus 290,000 francs for amortization of scrapped steam equipment was approved, to cover the electrification of the Erstfeld-Bellinzona line.

Communication Topics Discussed by A. I. E. E.

Papers on telephone-exchange traffic, the telegraph and telephone in railroad service, and the Goldschmidt system of radio-telegraphy read at March meeting of American Institute of Electrical Engineers

THE meeting of the American Institute of Electrical Engineers at New York March 13 was under the auspices of its committee on telegraphy and telephony, in conjunction with the Institute of Radio Engineers. Three papers were presented, those by A. I. E. E. members being "A Comparison of the Telegraph with the Telephone as a Means of Communication in Steam Railroad Operation," by Mr. M. H. Clapp, St. Paul, Minn., and "Traffic Studies in Automatic Switchboard Telephone Systems," by Mr. W. Lee Campbell, Chicago, Ill. On behalf of the Institute of Radio Engineers, Mr. E. E. Mayer presented a paper on "The Goldschmidt System of Radio-Telegraphy," which he illustrated with lantern slides. President C. O. Mailloux called upon Vice-chairman Cloyd Marshall of the telephony committee to preside in the absence of Chairman Frank F. Fowle, and Mr. John Stone Stone presided for the radio engineers.

Traffic Studies in Automatic Telephone Systems

Mr. Campbell's paper pointed out that a comprehensive analysis of telephone traffic should contain the number of calls made in a given period, the duration of each and the number of simultaneous connections made during rush hours. The author called attention to the disadvantages of the peg-and-plug count methods of recording traffic and described a new device which performs these duties automatically. This recorder consists of a mechanism for passing a continuous paper tape over forty electrically operated markers which record when and how long a trunk is occupied by a call. A record made by one of these devices on an automatic telephone system in Michigan showed that the trunks are idle during only remarkably short periods of time.

A "chartometer" may be used to sum up the duration of the calls on the trunks and the data then applied in plotting traffic curves. The curves show, as had previously been suspected, that large-trunk groups are more efficient than small-trunk groups, owing to the smaller ratio of the peak load to average load. From data obtained with the automatic recorder, a curve can also be plotted between the busy-hour calls carried per group of trunks and the trunks per group, to show the number of trunks needed at the peak instant for busy-hour loads of various sizes.

The average duration of about 10,000 calls observed in automatic plants is slightly in excess of 83 seconds, of which time 66.5 seconds was occupied in conversation and the remainder in making connections, waiting for the called party to respond and releasing the connection. An average duration of 43 seconds was noticed on some private-branch exchange calls and as high as 103 seconds in outlying residential-district offices. In the studies made by the author about 12 per cent of the calling parties received a busy signal, and 15 per cent received no response. The trunking scheme indicated herewith was suggested by the author for interconnecting two offices with a peak load in either direction of 175 busy-hour calls which do not occur at the same time.

The Telegraph Versus the Telephone in Train Dispatching

The principal physical characteristics of telephone and telegraph systems for train dispatching were compared in Mr. Clapp's paper, in which were also discussed the first cost, operating and maintenance expenses, and the advantages and disadvantages of each system. In the brief historical account of the development of electrical methods of communication, attention was directed to the fact that the first train was handled by telegraph in 1851 and by long-distance telephone in 1907. Trains are now dispatched by telephone over about 70,000 miles of railroad in the United States. Telephone circuits are not as well adapted for the transmission of railway messages, however, as for train dispatching, because the first use is justified only by a considerable amount of traffic.

Telegraph systems are preferable to telephones for railway use because of their relatively low first cost and simplicity of installation, operation and maintenance. Other advantages are the unsusceptibility of the telegraph to minor inductive disturbances and de-

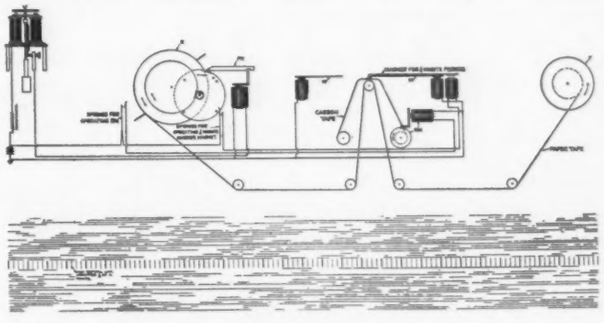


FIG. 1—TRAFFIC-RECORDING MACHINE AND SECTION OF RECORDER

fects in the circuit and the ability to transmit messages distinctly over long distances. The latter is more easy to obtain with the telegraph than the telephone, since the telegraph sounder is in a local circuit and does not depend for its operation on definite frequencies, waveshapes and amplitudes as does the telephone. Among the disadvantages of telegraphic communication are its lack of universality (only experienced operators can communicate with each other), lack of adaptability to emergency calls, slower rate of transmitting messages and inability to arouse the called operator as quickly as with a telephone bell. Considerable trouble is also experienced nowadays in obtaining competent operators especially during prosperous times or labor troubles.

In general practice on railway-telegraph systems, except near large transportation centers or where the lines are subjected to salt sea air, galvanized-iron wire is used for conductors. Of 9516 miles of telegraph circuits maintained by the Northern Pacific Railroad out of St. Paul, Minn., about 85 per cent operate quadruplex, 13 per cent single and about 2 per cent duplex. The estimated total number of messages on this entire system is about 5,000,000 per year, or about 833 mes-

sages per year per mile of main-line track. The labor cost per message in the relay offices is a trifle over 2 cents.

For telephone communication the author cited the following advantages: Universality of operation; direct communication between parties transacting business; speed in obtaining the called operator and in

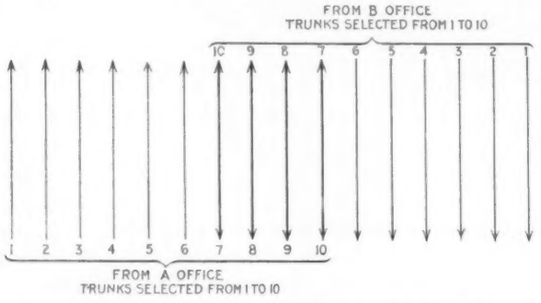


FIG. 2—TRUNKING SCHEME BETWEEN OFFICES ALLOWING 175 BUSY-HOUR CALLS IN BOTH DIRECTIONS

transmitting messages; psychological effect of the human voice in transmitting the message; decreased likelihood of disturbance from earth currents, aurora borealis, heavy fog, rain, mist and snow; lack of necessity of trained operators, and increased speed of handling trains. By copying communications down on a typewriter about twice as many messages can be received by telephone as by telegraph and the trains can consequently be handled from 10 to 20 per cent faster. By its use of telephones the Northern Pacific Railroad estimates that $200 per month is saved in overtime pay on one division alone.

COST OF FURNISHING AND INSTALLING VARIOUS PARTS OF A RAILWAY COMMUNICATING SYSTEM

TELEGRAPH SYSTEM	
No. 8 B. W. G. iron wire, per mile (including insulators, tie wires and pins)	$25.00
With intermediate offices, good for 200 miles.	
Without intermediate offices, good for 400 miles.	
Can be worked single, duplexed or quadruplexed.	
No. 9 B. & S. copper wire, per mile (copper at 15 cents per lb.)	38.00
Cutting in a way station (including gravity battery)	12.00
Ten-line in and out switchboard (peg type)	42.00
Twenty-five-line Western Union switchboard and eight sets of telegraph instruments	140.00
Nineteen-conductor cable (No. 14 A. W. G.) per connecting line to office	0.30
Quadruplex set	200.00
Single-line repeater set	50.00
TELEPHONE SYSTEM	
No. 9 A. W. G. copper wire, per mile (15 per cent copper)	$75.00
Good for 500-mile transmission.	
No. 6 A. W. G. copper wire, per mile (same basis)	150.00
Good for 1000-mile transmission.	
Selector, telephone and protector equipment per station (including wiring)	80.00
Dispatcher's telephone and selector equipment with battery	250.00
Selective telephone system along 100 miles of track, with thirty offices	10,000.00
Telephone booths on right-of-way, with equipment	30.00 to $90.00
Portable telephone sets	12.00

On the other hand, first cost and maintenance expenses of telephone equipment are higher than for the telegraph. Two wires are required instead of one, and transpositions and twisted-pair cables are necessary to prevent cross talk. A type of selector for railway telephone systems was described capable of calling 125 stations on the same line.

The author expressed belief that no railway telephone circuit should have a greater length than that equivalent to a 26-mile cable having a resistance of 88 ohms per unit (No. 19 A. W. C. metallic) and a mutual capacity of 0.054 microfarad per mile. He also prophesied that telegraphs will continue to be used for some time on railroads requiring from 500-mile to 1500-mile transmissions. The telephone, however, is not used, he conceded, so much as it could and should be.

Discussion

Messrs. William Mavor, Jr., W. E. Harkness, R. N. Hill, S. P. Grace and J. B. Taylor, all of New York, took part in the discussion of the foregoing papers.

Mr. Mavor said that, given the option of using the telegraph or the telephone over distances of from 200 miles to 1000 miles, his own experience had favored the accuracy, speed and reliability of telegraphic communication between expert operators, in comparison with which the uncertainty of some words in telephone conversation frequently called for repetition. The telephone is most useful, he declared, when the conversation concerns topics or words with which both speakers are familiar.

Mr. Harkness made the comment that operators using the telephone are under less nervous strain than those using the telegraph and can consequently handle nearly twice as much work, thus correspondingly reducing the pay-roll. The average Morse operator sends twenty-five to thirty words per minute, but by telephone the same man can transmit fifty to seventy-five words per minute. Installation of each telephone circuit incidentally makes available an additional telegraph line. Introduction of the telephone, said the speaker, has involved few telegraph operators losing their jobs, for they are necessarily first of all railroad men rather than telegraphers and hence can always make themselves useful elsewhere on the system.

Mr. Hill described the new "booster" type of telephone circuit, which he declared might be better characterized as a "conservation circuit" since it increases the efficiency of both the transmitter and receiving circuits.

Mr. Grace suggested that the traffic-recording device described in Mr. Campbell's paper might be applied to good advantage in manual exchanges. He also urged that more rugged design be introduced into telephone apparatus for railway use. Mr. Taylor pointed out that with respect to disturbances from outside power circuits the telegraph is less sensitive to extraneous cur-

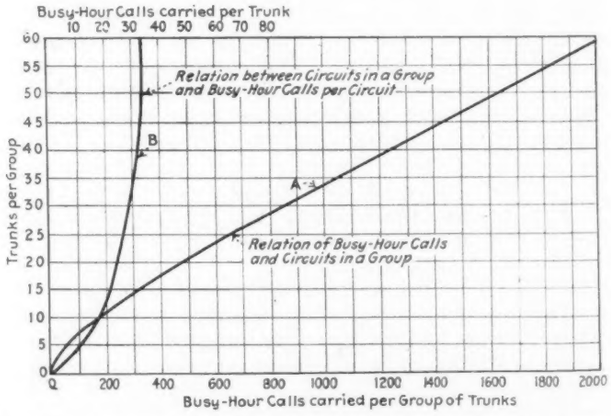

Busy-Hour Calls carried per Trunk
10 20 30 40 50 60 70 80
Trunks per Group
0 5 10 15 20 25 30 35 40 45 50 55 60
Relation between Circuits in a Group and Busy-Hour Calls per Circuit
B
A
Relation of Busy-Hour Calls and Circuits in a Group
0 200 400 600 800 1000 1200 1400 1600 1800 2000
Busy-Hour Calls carried per Group of Trunks

FIG. 3—CURVES TO DETERMINE TRUNKS NECESSARY FOR BUSY-HOUR CALLS

rents, while the advantage of the telephone lies in its operation with little regard to the actual magnitude of the speech current.

The Goldschmidt System of Radio-Telegraphy

After paying tribute to the work of Tesla, Fessenden and Alexanderson in developing high-frequency alter-

nators, Mr. Mayer described the high-power radio generators of Goldschmidt, particularly the 100-kw units for transatlantic communication. Starting with a frequency of 10,000 cycles, produced in the ordinary way, tuned circuits are employed to produce an alternating field which, acting with the rotation of the rotor, produces a frequency of 20,000 cycles. In turn this 20,000-cycle frequency, through tuned circuits, is again combined with the rotation to produce 30,000 cycles. Such addition of frequencies is limited only by the copper, iron and insulation losses, but for the best output it is necessary to keep the magnetic leakage low and to limit the number of reflections to four or five.

One of the machines described has 400 poles. Revolving 3000 times per minute, it produces, first, 10,000 cycles, and ultimately 50,000 cycles. The rotor weighs 5 tons and measures 4 ft. 1 in. in diameter. The poles are 0.4 in. wide, with one conductor per slot, each conductor consisting of a bundle of No. 40 insulated wires. Both rotor and stator are made up of iron sheets 0.002 in. thick, separated by paper 0.0012 in. thick. The air gap measures but 1/32 in., although the peripheral speed is about 625 ft. per second. If owing to misalignment the slots are even 1 mm out of adjustment, a loss of 20 per cent results. The sending key is in the excitation circuits, enabling the interruption of 5 kw to control the 100-kw output of the generator.

Since April, 1913, two such 100-kw machines (maximum output 200 kw) have been in operation at Neustadt, near Hanover, Germany, and at the Tuckerton (N. J.) station. The towers used are 825 ft. high, supporting thirty-six-wire double-cone antennas which are stretched to 40-ft. masts arranged in a 1500-ft. circle. The towers are supported on glass insulators.

The most notable feature of the receiving apparatus is the "tone-wheel," which makes and breaks the receiving circuit. If the receiving circuit is excited by a 50,000-cycle signal and the tone-wheel makes and breaks the circuit 50,000 times per second, no sound is heard in the telephone, but if the tone-wheel makes and breaks the circuit 49,000 times per second, a tone having a sound frequency of 1000 cycles will be heard in the telephone. The result is a musical note which penetrates "static" and permits of close tuning. By adjusting the tone-wheel to break in synchronism with the frequency of an interfering station, the interloper may be cut out.

Using these devices the Goldschmidt company has been able to telegraph from Eilvese, Germany, to Tuckerton, N. J., since the beginning of July, 1913. Mr. Mayer also intimated that his company has under way a telephone transmitter which will modulate sufficient energy to transmit speech wirelessly over long distances.

Discussion

Mr. Mayer's paper was discussed by Mr. R. H. Marriott, New York; Mr. E. F. W. Alexanderson, Schenectady, N. Y.; Dr. Lee De Forest, New York; Dr. M. I. Pupin, New York, and Mr. John Stone Stone, New York.

Mr. Marriott pointed out that messages from the Tuckerton station can probably be received over a minimum radius that includes Hanover, Germany, Spain, Peru, Alaska and the North Pole. At night under the best winter conditions it is even probable that the waves could be detected at 40,000 miles were such a terrestrial distance available. Mr. Marriott predicted that the time is near when news will be sent from one or two high-power transmitting stations to a great many inexpensive receiving stations scattered all over the world.

Mr. Alexanderson referred to the great difficulties besetting the design of a machine like the Goldschmidt high-frequency alternator, and referred to his earlier construction of a 15,000-cycle "trigger" alternator for use in wireless telephony. Later a constancy-controlling device was instead developed, employing the general principle of the transformer.

Dr. De Forest compared the advantages and disadvantages of the Goldschmidt system with the Poulsen arc for producing high frequencies. The Goldschmidt apparatus, he pointed out, has the drawbacks of high cost, complication of circuits and lack of flexibility. The Poulsen equipment has the disadvantages of requiring occasional changes of electrodes, attention to the gas supply and the water-cooling supply, and lower efficiency. During the last three years the efficiency of the large Poulsen generators has been increased from 30 per cent to 60 per cent. At New York, however, signals are received from the 60-kw South San Francisco plant with considerably more distinctness than from the 150-kw station at Hanover, Germany.

Dr. Pupin commented on the fact that he had lectured on the principle of the machine described by Mr. Mayer five or six years before Mr. Goldschmidt actually developed it. From his own investigations he detected in the secondary a very large number of frequencies, recognizing 136 harmonics within the limit of audibility. In this type of machine, however, Dr. Pupin declared that he had never placed much confidence on account of its large magnetic leakage, large losses, crowding of many currents requiring iron and copper conducting area, etc. He promised, however, to describe shortly before the A. I. E. E. another machine which differs in principle from the first and which he considers a great improvement. In closing, Professor Pupin paid a high tribute to the skill and art of the constructors of the Goldschmidt apparatus and the completeness and persistency with which they carried out their undertaking.

Mr. Stone pointed out how Mr. Mayer's paper revealed the recent increase in wave-lengths, resulting in the gradual but rapid departure from the highly damped wave train of the early open-spark systems, and finally leading to continuous or undamped wave trains. Had the wave lengths used at the Tuckerton station been made to correspond to the fundamental of the antenna, or approximately 1500 meters instead of 6000 meters, the radiating power of the antenna, said Mr. Stone, would have been sixteen times greater, while the receiving or absorptive power of distant receiving stations would have been similarly increased approximately sixteen-fold. Such a wave-length would require, however, a frequency of 200,000 cycles.

Electrical Voting Device for the House of Representatives

An electrical device which, by automatically recording the votes of the members, will replace the arduous task of calling the roll in the national House of Representatives is being considered by the rules committee of that legislative body. Aside from eliminating the forty-five-minute roll call, this device will do away with the delay in action sometimes caused by obstinate minorities.

To record the attendance and votes of the members, at the same time preventing interference from unauthorized persons, the apparatus will consist of locked push-buttons at each representative's seat and a recording device operating on the principle of an adding machine.

To each member of the House will be assigned a particular seat, which will be numbered. At each of

these positions there will be a push-button for indicating a positive or negative vote, the presence of the seat holder, and possibly a paired vote.

The recording apparatus, which will be installed at the Speaker's desk, will automatically register on a card bearing the names of all members, by punching a hole in one of the columns marked "yea," "nay," "present" or "paired" opposite each name. The device will be designed also to add the votes when a lever is pressed. The stamped card may then be removed from the machine and kept as a record of the particular vote written across it.

To inform the members how a vote is progressing several indicating devices will be placed at different points in the House. These devices will have bulletin boards bearing the names of all the Representatives and will indicate their votes as soon as they are cast, by illuminating differently colored lenses, probably red for "yea" and blue for "nay."

The advantages of this system of voting will be absolute accuracy, considerable saving in time, and accessibility of records. The scheme was devised by Representative Walsh, of New Jersey, who was assisted in designing a device meeting the requirements of voting by Representative Garret, of Tennessee, Speaker Clark and others, including Mr. Elliott Woods, superintendent of the Capitol.

Result of Electrolysis Mitigation Methods in Springfield, Ohio.

In the *Electrical World* for Jan. 31, 1914, were printed editorial comments relating to suggestions made by the United States Bureau of Standards for minimizing electrolysis in Springfield, Ohio. Since that time the proposed installation of insulated negative feeders has been made together with additions that were considered necessary to make a complete arrangement. Recently a series of tests were made upon the new system, and the report upon these has been issued in Springfield by the committee of investigation, which included representatives of the National Bureau of Standards, the city of Springfield and the telephone, telegraph and gas companies in the city.

The system actually installed included insulated return feeders for the Ohio Electric Railway as well as for the Springfield Railway Company, the former company now having installed negative copper amounting to 33 per cent of its positive copper, and the latter company 35 per cent. The conditions were very favorable to a system of insulated negative feeders owing to the fact that the substations of the two companies were at opposite sides of the city so that by interconnecting the tracks it has been possible to interchange current on the negative sides to a very considerable degree, thus aiding in securing low potential differences.

The negative feeders were designed to reduce the potential gradient in all parts of the track system to a mean value not exceeding 0.5 volt per 1000 ft. under net average schedule traffic. This corresponds to approximately 0.8 volt per 1000 ft. averaged during the hour of peak load. The test data show that this condition has been substantially realized.

In the report it is stated that the present conditions existing in Springfield correspond to those prevailing in cities in Great Britain and Germany where experience has shown that there is substantial freedom from injury by electrolysis. The regulations in effect in Great Britain limit the maximum over-all voltage drop in any city to 7 volts, the maximum being defined as a mean value between the highest momentary peak and the average for the hour of maximum load. In Springfield the tests showed that the highest value obtained exceeded the British limit by only 2 volts, and in the majority of cases the over-all voltage readings were considerably lower. The limiting value prescribed in Germany prevents the over-all voltage within city limits from exceeding 2.5 volts during average schedule traffic. In Springfield only 19 per cent of the readings were above this value.

With regard to potential gradient measurements the highest average value in Springfield for any one hour was 0.98 volt per 1000 ft., where there were defects in the track which could be repaired. The average of all the values obtained throughout the city was 0.23 volt per 1000 ft. The German regulations prescribe for suburban lines a gradient limit of 0.3 volt per 1000 ft. of track during average scheduled traffic. In Springfield the average of all peak load gradients is found to be 0.35 volt for the hour and 0.64 volt for the highest ten-minute period.

The over-all voltage prescribed by law in Lorain, Findley, Galion, Fremont and Canton, Ohio, is limited to 7 volts between any two points on the non-insulated portion of the track return during the ten minutes showing the highest value, and the potential gradient for the corresponding period is limited to 1 volt per 1000 ft. The values of over-all voltages and potential gradients existing in Springfield are considerably below these limits, except in isolated cases where there is bad rail bonding.

From the results obtained the authors of the report state that they are convinced that the insulated return-feeder system combined with proper maintenance of track bonding is the best means of dealing with the electrolysis problem in all cases where it is not practicable to insulate the tracks from the ground. They make strenuous objection to the use of pipe drainage under any circumstances for the city of Springfield, but instead recommend that the insulated return-feeder system should be supplemented by a certain proportion of insulating joints in the water pipes and the gas pipes.

With regard to lead cable sheaths of the telephone and telegraph companies, however, they say that it would not be commercially practicable to extend the insulated return-feeder system so that these could be safeguarded against electrolytic action. It is therefore cheaper to apply a limited amount of drainage protection to the cables, which can be protected in this way. The problem of draining cables differs in many respects from that of draining pipes, particularly in that cables are continuous conductors and the difficulties arising from high resistance joints are not encountered. Great care, however, should be exercised not to overdrain the cables, as such overdrainage may involve danger of electrolytic action that will damage neighboring structures.

The report presents definite recommendations which are briefly as follows:

(1) The insulated return feeders now installed should be made permanent, subject to necessary extensions.

(2) No insulated negative feeders are necessary on the interurban lines in the city at the present time, on account of the light loads.

(3) All electric railway tracks within the city limits should be so constructed and maintained that no rail joint will exceed the resistances of 8 ft. of rail.

(4) All tracks within city limits should be inspected once each year.

(5) No metallic connections between water or gas pipes and the railway return circuit should be permitted.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

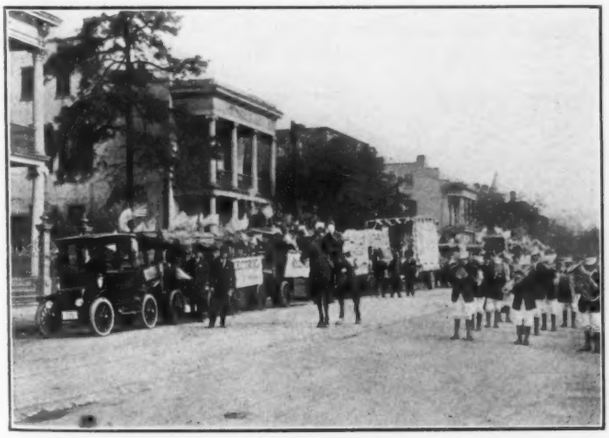
The Influence of Suggestion

A firm believer in the influence of suggestion, Mr. C. H. Felker, assistant new-business manager of the Toledo Railways & Light Company, turned on his own porch lamp every night during the month of December. He gave no reason to his neighbors for so doing, nor did he mention to them the fact that he was operating this lamp continuously. However, by the tenth of the month ten of Mr. Felker's neighbors on both sides of the street were operating their porch lamps every night. The fact that this was not a coincidence was established when on Jan. 1 Mr. Felker discontinued the operation of his porch lamp and was followed by all of his neighbors.

A lesson, and perhaps a suggestion, is to be found in this incident as viewed from the standpoint of an electrical salesman. The suggestion has been made that it might be a good investment for central-station companies to furnish all employees in the new-business department with energy, either at a reduced rate or free of charge, in order that they might set examples to their neighbors by keeping their houses brilliantly lighted.

Electric-Vehicle Parade in New Orleans' Mardi Gras

A street parade of electric vehicles was a feature of New Orleans' Mardi Gras celebration of 1914. A number of shining electric coupés and runabouts headed the procession, and these were followed by twenty elaborately decorated electric trucks carrying banners advertising the advantages of electric vehicles. With its band and bugle corps, the procession measured three city



ELECTRIC VEHICLES IN NEW ORLEANS MARDI GRAS PROCESSION

blocks in length. The parade was arranged by Mr. William E. Clement, commercial agent of the New Orleans Railway & Light Company, who is also secretary of the recently organized Electric Vehicle Association of New Orleans. Mr. Thomas Bart Rhodes is president of the new association, with which the local branch of the Jovian Order participated in the Mardi Gras parade.

House-to-House Demonstration of Washing Machines and Vacuum Cleaners

With its accustomed enterprise, the Denver Gas & Electric Light Company is making free demonstrations of the use of electric washing machines, electric vacuum cleaners and other domestic electric appliances. This

DEMONSTRATING WASHING MACHINES AND VACUUM CLEANERS AT DENVER

method is adopted to introduce these modern conveniences in the homes of the company's residence customers. As shown in the accompanying illustration, a 1,500-lb. electric delivery wagon of local construction is used for the delivery of appliances of this character. The driver is an employee of the company who is also skilled in demonstrating and repairing electrical apparatus. He makes many of his deliveries alone and himself installs the washing machine, vacuum cleaner or other device that may be under consideration. He then demonstrates how the apparatus is used and goes away. Another representative of the company calls within a day or two in order either to make a sale of the appliance or to order it transferred to another home. In a large percentage of the cases these demonstrations result in sales.

Co-operative Benefit Association for Columbus Employees

Bulletins recently issued by the Columbus Railway & Light Company, Columbus, Ohio, announce that a Co-operative Beneficial Association will soon be inaugurated there, incorporating both an insurance system and a pension plan. Any white employee who has been in the service of the company for three months and who is not less than eighteen years of age nor more than forty-five years of age, and who is receiving a salary not exceeding $200 a month, will be eligible for membership. The entrance fee is $1, with monthly dues of 50 cents, the company contributing to the funds of the association each month the equivalent of one-half of the total monthly income of the association paid by its mem-

bers. Sick benefits will amount to $1 a day for a period not exceeding twenty-six weeks. The insurance system covers employees who have been in the service of the company for more than two years. Pensions will be awarded to workmen who attain the age of sixty-five years after having completed twenty years of continuous service with the company.

Coffee with Your Lighting-Bill Receipt

During the cold, raw days, when the month of March "came in like a lion," patrons of the Massillon (Ohio) Electric & Gas Company, in the neighboring village of Orrville, were served with hot coffee when they came to the Orrville branch office to pay their electric-light bills. Mr. O. A. Acuff, new-business manager for the Massillon company, made arrangements with the local man who handles collections so that for all who came to the office during the cold period a cup of the steaming beverage was waiting. Such thoughtfulness on the part of the public-service company certainly cemented a closer relationship with the local public, showing them that a corporation properly conducted is not without a heart.

Energy-Consumption Data from Eight Brick Factories in St. Louis

The new-business department of the Union Electric Light & Power Company, St. Louis, Mo., has been particularly successful in equipping dry-press brick plants in and about the city with motor drive. Comparison of the data collected from these plants brings out some interesting facts and also shows what results can be expected from motor drive in similar installations. Equipment in plants Nos. 1, 2 and 3 is practically the same, but the energy consumption for No. 3 is shown to be considerably lower than either of the others. This is, however, accounted for by the fact that plant No. 3 was in operation only during the most favorable season of the year. So, eliminating this figure, the energy consumed in the manufacture of 1000 bricks may be said to range from 4.45 kw-hr. to 8 kw-hr., according to the number of machines which are electrically driven.

When these unit energy figures are multiplied by the cost of electricity and compared with the costs of operation in steam-driven mills (for St. Louis approximately 24.5 cents per 1000 bricks), the advantage of electric drive stands out quite clearly.

DATA ON EIGHT MOTOR-DRIVEN BRICK PLANTS

Plant No. 1, 30-hp Motor	Plant No. 2, 20-hp Motor	Plant No. 3, 20-hp Motor	Plant No. 4, 30-hp Motor
One five-mold brick machine	One five-mold brick machine	One five-mold brick machine	Two four-mold brick machines
One set rolls	One set rolls	One set rolls	One two-mold hammer
One mixer	One mixer	One mixer	Four disintegrators
One elevator	One elevator	One elevator	One conveyor
			Two mixers
Kw-hr. per 1000 bricks, 5.18	Kw-hr. per 1000 bricks, 4.45	Kw-hr. per 1000 bricks, 3.10	Kw-hr. per 1000 bricks, 4.5

Plant No. 5, 50-hp Motor	Plant No. 6, 10-hp Motor 40-hp Motor	Plant No. 7, 75-hp Motor	Plant No. 8, 50-hp Motor
Two-four-mold brick machines	Two five-mold brick machines	Two six-mold brick machines	One six-mold brick machine
One two-mold hammer	One set rolls	One two-mold brick machine	One two-mold brick machine
Four disintegrators	One elevator	Four mold hammers	Two disintegrators
One conveyor	One screen	One 60-in. disintegrator	Cup elevator
Two mixers	Machine shop	One set rolls	Kw-hr. per 1000 bricks, 8
Kw-hr. per 1000 bricks, 4.5	Kw-hr. per 1000 bricks, 5.6	Cup elevator	
		Kw-hr. per 1000 bricks, 8	

Supply Dealers' Exhibits in a Central-Station Showroom

Several months prior to the recent rearrangement of its general offices the Merchants' Heat & Light Company, of Indianapolis, Ind., took up with the six leading local electrical supply houses the question of opening, on a co-operative basis, an "electric shop" in its new showroom, at 33 South Meridian Street. As the result of several conferences it was finally decided that the company would furnish in the showroom a table for each supply house, and on these the dealers now make representative displays of the appliances sold by them. The tables selected have 8-ft. by 3½-ft. tops and are covered with green felt.

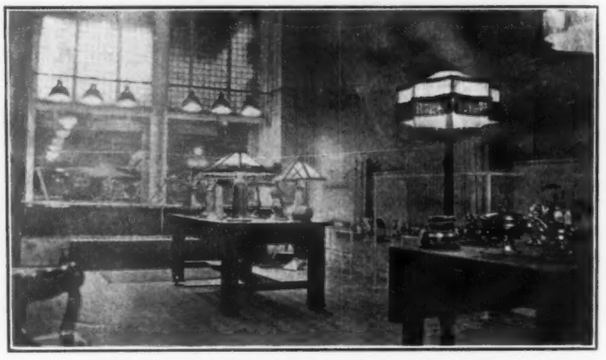


FIG. 1—DEALER'S EXHIBIT TABLES IN CENTRAL-STATION SHOWROOM

The plan being followed at the present time is working out to great advantage to both parties, according to Mr. C. F. Klu, assistant sales manager. When a customer comes in and selects an appliance from a certain table an order is taken and sent to the corresponding supply house, which then makes the delivery from its own stock. If the order is a C. O. D. account the central-station company is credited with a percentage on

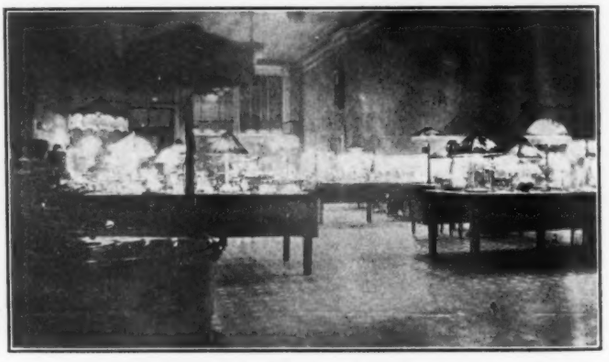


FIG. 2—SHOWROOM OF MERCHANTS' HEAT & LIGHT COMPANY, INDIANAPOLIS

the sale. If it is a cash sale, the company sends the supply firm a requisition and is billed in the usual course of business. In this way each supply dealer's table at all times has on it the original consignment. If, however, the customer desires to take with him the appliance he has selected, he is allowed to do so and a requisition is issued to the supply house, which immediately sends another appliance to take the place of the one carried away. In every case the customer is invited to look over all the different devices on display and to make his own choice. The prices on all goods exhibited are maintained by the Merchants' company at the same values as listed by the supply houses themselves.

In addition the company has itself put on display about fifty floor and table lamps. The prices of these will be maintained at about the same level as those charged by the dealers.

In the front of the room is a display window measuring about 15 ft. by 5 ft. This window is given over in turn to each supply house for a week at a time. Each dealer is supposed to dress the window and to take care of it during the time it is in his charge. In this way each supply house has the window every sixth week.

In the front of the main showroom, as shown in Fig. 1, are displayed two steam radiators, with regulators and meters attached. With these it is expected to explain to customers the advantages of buying steam heat on a meter basis. One of these radiators is also equipped with a "built-in" oven, in which the housewife can warm plates before serving dinner.

At the rear of the room is the cashier's desk, and back of her booth is a rest-room fitted up for women customers. This room is equipped with a telephone and writing desk and will have a maid in attendance. The display room is in charge of the chief clerk, with a young woman assistant. In addition to his duties as salesman, the clerk attends to any complaints that customers may wish to make with regard to service or bills.

It was intended to have a formal opening of the room some time during March. It is also planned to give special demonstrations from time to time, for which special invitations will be issued. During one week, for instance, an experienced woman will demonstrate a chafing dish, preparing various good things to eat for the instruction of visitors. Such a demonstration will be followed with others on the uses of electric irons, toasters, washing machines, vacuum cleaners, etc.

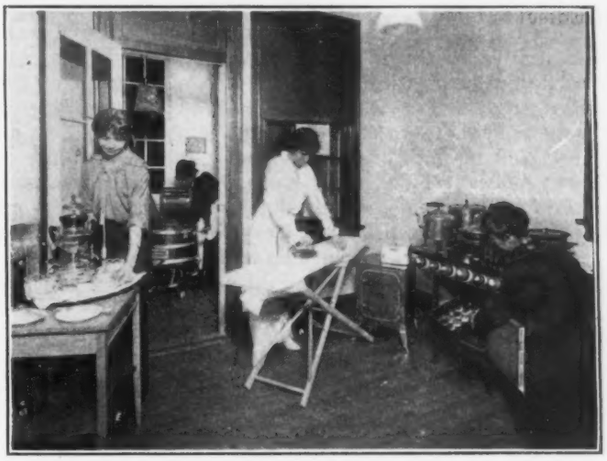
So far, with no advertising and with only the attendance of the customers who come into the office to pay bills, the sales in the showroom have been very gratifying. As soon as the room is formally opened the electric shop will be advertised extensively in the local papers.

The "House Electric" of the Potomac Electric Power Company

The Potomac Electric Power Company, of Washington, D. C., is operating an electric house at Chevy Chase, Md., one of the fashionable residential suburbs of Washington, and in this model dwelling are shown all kinds of electric heating, lighting and mechanical appliances.

A building contractor has given the company the use of the newly completed house, and the power company put in the special wiring for the electrical devices. It has also employed operators to demonstrate the labor-saving, cleanly and safety qualities of the devices. Washington retail merchants loaned the interior furnishings, a pianola and a victrola.

Incidentally the house is being regularly used as a residence, the demonstrators sleeping there and cooking all of their meals on an electric stove. Visitors are met at the door by a maid, and after they have taken off their wraps, one of the demonstrators shows them over the entire house and operates the various electric devices. In the kitchen the callers are served with coffee made in an electric percolator and hot biscuit cooked in the electric stove. On the back porch there is a meter



KITCHEN OF WASHINGTON'S "HOUSE ELECTRIC"

exhibit showing the saving effected by the use of tungsten lamps instead of carbon units.

Near the car line a large electric sign directs attention to the "House Electric," as it is called, and two 750-watt nitrogen-filled lamps iluminate the way. Callers are asked to register when leaving the house, and during one three-week period there were more than two thousand visitors.

A Lamp-Post Centerpiece for Window Displays

The Central Illinois Public Service Company, which operates interconnected properties in the southern central portion of the State, is using a miniature ornamental lighting standard, fully equipped, as the centerpiece for its window displays. When the little lighting standard has ceased to be an attraction in one city it is moved to the next and exhibited there. Although at present no concerted effort is being made to secure street-lighting contracts, the impression created on the minds of the various communities will be favorable and

WINDOW DISPLAY, MATTOON, ILL.

lasting, so that when the time comes for talking "white ways" in towns not yet supplied with adequate lighting systems everyone will have a definite idea of what an ornamental lighting standard is. The illustration herewith shows the window display grouped about the miniature post in the company's central office at Mattoon, Ill.

Illumination and Wiring

Electric Line Wagons of the Commonwealth Edison Company, Chicago

In its service and repair work the Commonwealth Edison Company, Chicago, makes use of a number of specially designed electric trucks each of which is a veritable supply store. Doors which let down at the sides give easy access to the numerous compartments with which the truck bodies are equipped, so that all tools and supplies are readily reached from the sides of the vehicle. The company has a dozen of these wagons, having purchased the initial lot of eight trucks more than twelve months ago, since which time they have been in continuous successful service.

Near the forward end on the left side of the truck body, as shown in Fig. 1, is a group of some twenty pigeon-hole compartments for the drills, saws, wrenches, etc. Behind these are two large metal-lined compartments for the gasoline cans and furnace, and

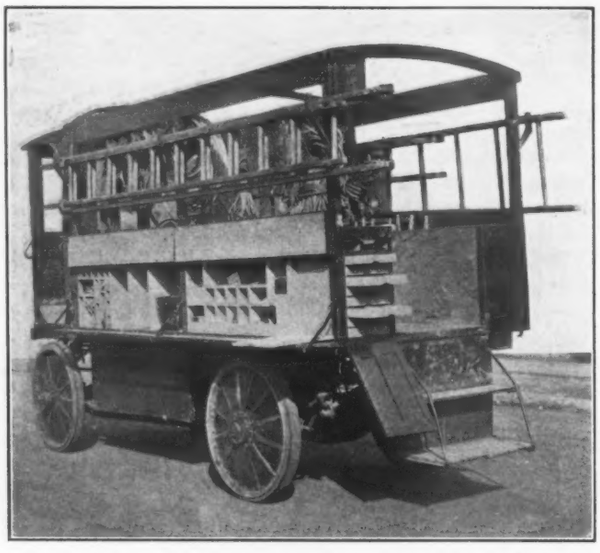


FIG. 1—ELECTRIC WAGON, SHOWING COMPARTMENTS FOR TOOLS AND HARDWARE

next comes a third full-size space in which are carried salt and water for the preparation of ground-pipe connections. At the rear is a second group of compartments and drawers for the solder, taps, primary cut-outs and such small hardware as bolts, screws, steps, washers, etc.

The long compartment on the right-hand side near the front (Fig. 2) provides for laying out rubber coats, boots, etc., at full length, preventing cracking due to folding. The spaces below are for brackets and short braces. In the group behind the horizontal openings are seen the drawers for the glass insulators. These have pins which support the insulators out of the way of injury to one another. The rear compartment contains knobs, strain insulators, spurs, belt tools, etc.

The side doors which close these compartments swing downward and serve as shelves for sorting material. On the uprights are racks for holding the ground-wire molding, ground pipes, cross-arm braces, etc. The inside of the body is approached from the rear by a pair of easy steps, and at the left of the end gate are eight trays of various lengths for framing bolts.

Forward in the body of the car are two pay-out reels of wire, and adjoining these there is space for carrying transformers. Coils of rope and extension ladders are carried on hooks on the side standards. The latter also support a frame over which a tarpaulin can be thrown in rainy weather.

The trucks described were designed primarily for the installation of customers' services from the overhead system, but they have also been found well adapted to

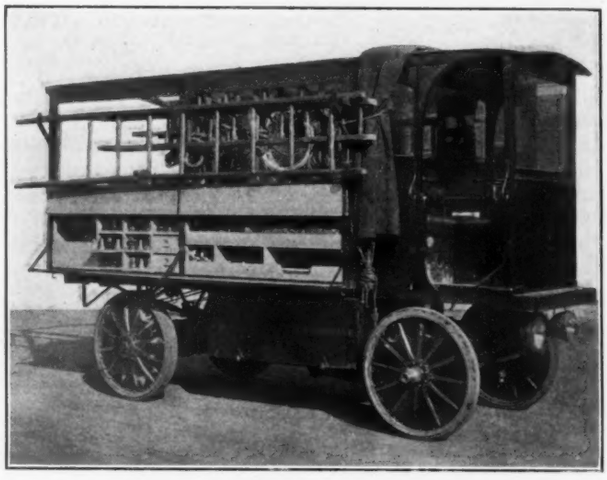


FIG. 2—DRAWERS FOR INSULATORS, LINE MATERIAL, ETC.

repair work and line extensions which do not require pole setting. The trucks were built by the Walker Electric Vehicle Company at its Chicago factory.

Handy-Box for Examining Photographic Negatives

The box shown on the counter in the accompanying photograph represents another electrical device for the convenience of the photographer, the object being to avoid the tiresome process of holding developed and finished negatives repeatedly up to daylight in order to identify or study their features. In the arrangement shown two 8-cp incandescent lamps of the tubular type are mounted on the inside of a triangular box about 7 in. long, 6 in. wide and 6 in. high. On the front of the box is a double ground-glass cover against which the negative is laid when under examination, the glass

HANDY BOX FOR EXAMINING NEGATIVES

top being 4.75 in. wide and 6.75 in. long and mounted on four brass posts 1 in. high. A snap switch on the side of the box controls the lamp's operation; the rear side is open, with a light cardboard curtain to enable the heat from the lamps to be readily dissipated, and electricity is supplied by a flexible pair of wires plugged into a flush receptacle in the counter.

Nitrogen Lamps and Concrete Posts

Without exaggeration it may be said that the curb lighting before the Park Vaudeville Theater on the West Side of St. Louis, Mo., is the last word in exterior illumination. Here, as shown in the illustrations, are installed four 750-watt nitrogen-filled tungsten lamps

CURB-LIGHTING UNITS, PARK THEATER, ST. LOUIS, MO.

in Alba globes. At night these units light the street for considerable distances at both sides of the building. Four other similar units will be installed on the face of the building near its top. The units at the curb are supported on concrete columns of neat and simple design which harmonize well with the exterior of the theater.

At another theater under the same management nitrogen lamps have been used to replace the internal parts of several old arc lamps which were rendering inefficient service as exterior illuminants.

An Electric Sign on a Gate

A Boston (Mass.) trucking house utilizes electricity to advantage to light a somewhat unusual sign mounted on an alleyway gate just outside the office of the firm.

ELECTRIC SIGN ON GATE

When the gate is closed the two halves swing together and two triangular electric signs are switched into service by hand, the central portion of the gate being occupied by two circular signs, 24 in. in diameter, bearing the street number and the words "Auto Truck Service." The triangular signs are each 6 ft. high and contain five 16-cp frosted lamps, while the circular signs contain three lamps each, of the same size. The controlling switches are of the push type and are inserted in the circuit of a flexible pair of wires terminating at the sign proper and connecting with flexible metal duct on the wall at the rear of the gate.

Durability of Cable Circuits

On account of dredging operations by the government in the neighborhood of Coney Island and Jamaica Bay, New York, the Commercial Cable Company was recently forced to relocate its cables which connect two transatlantic and other deep-sea circuits. The route from the main office in New York now extends to Far Rockaway instead of to a point on the eastern end of Coney Island. A new underground line was laid between New York and Far Rockaway.

The transfer of the ocean cables and the connection with the office having been accomplished, there was no further use for the cables over the Coney Island route, so it was decided to take them out of the conduits and utilize them as extra conductors over the Far Rockaway line. This installation consisted of three cables of four conductors laid in 1900 and three cables of four conductors laid in 1904, and it was made by the Okonite Company, New York. Tests show the electrical and physical conditions of the conductors to be practically unimpaired after ten and fourteen years of uninterrupted service.

Recent Telephone Patents

Difficulty has sometimes been encountered with automatic-exchange systems in operating lines of different classes. In order to overcome this difficulty Mr. F. R. McBerty, of New Rochelle, N. Y., has invented an automatic-exchange system which was patented recently for working the direct-line, party line and underlined groups, as well as interchangeable lines. For party lines, however, an individual contact set in the contact banks is assigned to each station, the designation of each station comprising a number only. A "busy" circuit may be interconnected between all contact sets of the line, thus eliminating interference. Reversals may be made automatically to insure the proper ringing current for selecting the desired station only. The contact sets of all the lines of underlined groups are so wired that when a call is made and the first set is busy, the selector will try the successive ones of the group until one not busy is located. If all are being used, the busy signal will be given. Automatic ringing is employed throughout. The key to the system lies in the association of a polarized and a current-strength relay in the busy test circuit so that combinations of these two, both acting differently, determine the subsequent result. This patent is assigned to the Western Electric Company.

Mr. M. L. Johnson, of Chicago, has also obtained several patents relating to the operation of party lines with automatic systems, these patents being assigned to the Corwin Telephone Manufacturing Company, of Chicago. In all these systems relays are located at the substations, and when any station has the line either for incoming or outgoing purposes the telephone talking apparatus and the impulse-sending switches are cut out at all the other stations of the line. This is accomplished by controlling these circuits jointly through a polarized relay and a light-resistance relay at each station, the latter latching the hook switch. An additional feature of these systems which relates to both automatic and manual working is the running of an auxiliary line between stations of the party line with means for intercommunication without effect upon the exchange line.

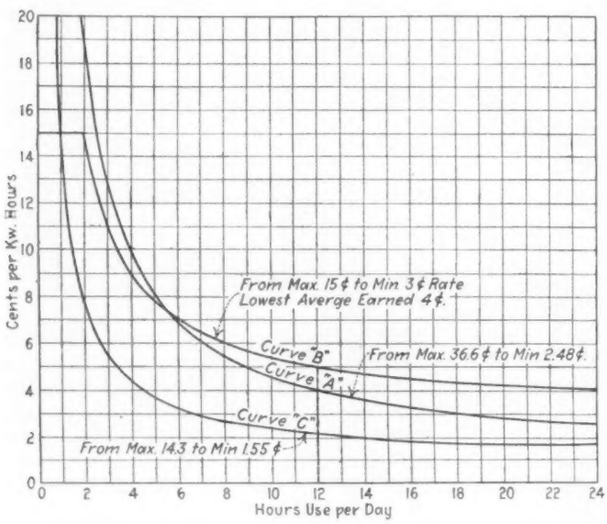
Letters to the Editors

Electric-Service Rates

To the Editors of the Electrical World:

SIRS:—Perhaps no subject of interest to the public has received more attention during the past few years than that of electric energy and service rates. The searchlight of investigation has been thrown on it from every angle by state commissions, private experts and electric property operators. It is fair to say that these investigations, both on the part of the consumers and the companies, have been made with the prime view of arriving at the real truth. Electric rate making has, therefore, passed from the haphazard guess methods of a few years ago to a science in which due consideration is given to every factor affecting the question. On this question there is and must always be more or less disagreement, and it is only through such disagreements and diversity of opinion that the real truth is ultimately to be arrived at.

In the making of a proper rate there must necessarily be taken into consideration the following factors:


Cents per Kw. Hours
Hours Use per Day
From Max. 15¢ to Min 3¢ Rate
Lowest Averge Earned 4¢.
Curve "B"
From Max. 36.6¢ to Min 2.48¢.
Curve "A"
Curve "C"
From Max. 14.3 to Min 1.55¢

CURVE CHART SHOWING VARIATION OF ELECTRIC-SERVICE RATES

First—A proper interest return on the investment.

Second—A depreciation charge that will not only cover loss through wear and tear but will also provide for the cost of discarding machinery, as is constantly made necessary through the rapid developments, improvements and changes in electric generating and distributing apparatus.

Third—The cost of labor.

Fourth—The lubricating and fuel costs.

The above naturally divide themselves into two classes that are properly known as fixed costs and varying costs. The first two items constitute the fixed cost. The labor cost, or third item, is properly divided between the two classes but belongs primarily to the first classification, and for simplicity may be thus treated. The fourth item constitutes the varying cost.

In making a rate the aim is so to arrange the schedule that under all conditions of the requirements of the consumer he will always pay a price that will net the company a just and fair return. The form of the bill should be as simple and as easily understood as it is possible to make it. This should also apply to the application or contract. The expert, absorbed as he is in his study, is apt to lose sight of the fact that to the large majority of users "kilowatt," "kilowatt-hours," "maximum demands," "minimum demands," "load-factors" and other technical expressions are pure Greek and the direct cause of much misunderstanding.

In the opinion of the writer, a fair rate should be one that protects the company at every point of use, whether by a one-hour-a-day user or a twenty-four-hour-a-day user. It, therefore, becomes a rate that varies from a maximum charge for energy to the short-hour user to a minimum rate to the long-hour user. It should be such a rate that on a station demand of 100 lamps used on an average ten hours per day the price paid by the consumer per kilowatt-hour should be practically the same as that paid where the demand is 1000 lamps on the station, the only difference being the saving to the company in getting its revenue at a reduced transformer, meter and office expense where the same amount of energy is furnished to one customer rather than to ten.

In arriving at a rate, the curve chart is most useful and expedient, and on it should first be outlined the costs of operation, varying from an amount of energy sold equivalent to what the plant could turn out (with proper reserve amount set aside for protection in case of shut-down of active units) in one hour per day running to what it would turn out in twenty-four hours' constant operation.

After some fifteen years' experience, during which time many rates have been worked out and tried, the following simplified method has been developed: The equivalent of two hours' use per day of the station demand at X cents per kw-hr. All use in excess at Y cents per kw-hr.

Applying this rate to such a plant as is found in towns of from 5000 to 6000 inhabitants—say, a plant consisting of two 150-kw units, one for use and one for reserve—the following would result:

Assume that the actual investment was $75,000; that the labor, as paid out for salaries to superintendent, engineers, firemen, linemen and office help, was $600 per month; that the total fuel bill and cost of lubricants divided by the monthly kilowatt-hours output was 1 cent per kw-hr.; then, with interest charge at 8 per cent, $500 per month; depreciation at 8 per cent, $500 per month; labor, $600 per month, the total fixed charge would be $1600 per month.

A 150-kw plant, running on a one-hour-a-day load-factor would generate 4500 kw-hr. per month at a fixed cost of $1600, plus a fuel cost of 1 cent per kw-hr., or $45. The cost per kilowatt-hour under one-hour load conditions would, therefore, be $1600 \div 4500 + 1$ cent per kw-hr. $= 35.6 + 1 = 36.6$. Under twenty-four-hour load the cost would be 2.48 cents per kw-hr., as shown in the accompanying curve sheet at A. Assuming the maximum price allowed under franchise rights is 15 cents per kw-hr., the following rate could be made: Rate X, or first two hours' use per month of the demand, at 15 cents per kw-hr. Rate Y, or excess use, at 3 cents per kw-hr. The results are shown in curve B. From this rate the maximum paid for energy would be 15 cents per kw-hr. The lowest average rate that could be earned would be 4 cents per kw-hr.

To credit the large consumer with the reduced cost to the company for transformers and meters, a quantity discount of 1 per cent for each ten-dollar value of the bill up to 25 per cent could be allowed, and on account of saving in expense of collecting a cash discount of 1 per cent for cash payment on or before the 10th instant could also be allowed. As an offset to the loss shown by the chart up to a five and one-half hours' use, a minimum charge of 5 cents per lamp (50-watt) should be required on commercial lighting, but not less than $1, and no installation should be considered less

than 1000 watts. With this addition, the rate not only enables the long-hour user to obtain a low average rate but also guarantees to the company a fair return.

By careful analysis of local conditions and manner of use, a basis of estimating the active installation or actual demand should be worked out, the value usually ranging in commercial lighting from 90 per cent to 50 per cent, on motor service from 75 per cent to 25 per cent, and on residence use from 75 per cent to 25 per cent.

W. A. SMITH,
Vice-president the Light & Developing Company.
St. Louis, Mo.

Rates for Electricity

To the Editors of the Electrical World:

SIRS:—I have been much interested in the letters in your paper regarding rates on electricity, for it is a subject upon which I have spent much time, and I am fast getting to the point where I believe that the public service companies, particularly the large ones, are not serving the best interests of the community, or even their own best interests, by taking contracts for either lighting or motor service in large quantities at very low prices.

The electric companies state that the large users can be served at low price because their load for the most part is off-peak and the amount of power used is so large that they can afford to sell the energy at a very low rate. The amount of power used by these companies may be large, but that it represents an off-peak load is not true. Practically every one of the large users of energy either for lighting or motor service demands service during the peak period. It may be for only two or three hours during three or four months of the year, but it occurs during the peak and therefore requires in the station apparatus for generating, and in the streets apparatus for distributing, the energy which would not be required if this load did not exist. Under these conditions the people who should pay for the interest, maintenance and depreciation as well as the operating charges on the machinery are those who make this apparatus necessary, namely, the large as well as the small users.

According to the figures of one of the very large generating companies for 1909, the average rates for motor service were 4.47 cents per kw-hr. The amount of energy delivered was approximately 92,244,000 kw-hr. Assuming that energy was used for 365 days out of the year, this would represent 253,000 kw-hr. per day, and assuming a use for nine hours a day the average kilowatts or the total kilowatt rating required in the station, not allowing for transmission losses, would be 28,100. For illustration purposes, assume this as a peak load, which is manifestly incorrect but errs in being too small and not too large. Assuming that the indicated rated equipment could be installed with its distributing lines for $300 per kilowatt, including all costs against the plant—which is a low figure when one takes into account costs in a large city—the total cost would equal $8,430,000. Allowing 16 per cent for interest, maintenance and depreciation, the annual cost would be $1,348,800, or approximately 1.46 cents per kw-hr. for these three fixed charges, no allowance whatever being made either for taxes or for operating charges.

From the amount of energy sold and the average price it is found that 42.4 per cent of the energy was sold at 1.44 cents per kw-hr., or less than the interest charges on the investment of the apparatus required to produce it. Five per cent was sold at an average of 1.99 cents, 5.5 per cent at an average of 1.88 cents, 2 per cent at an average of 4.03 cents and 45.1 per cent at an average of 7.97 cents. In other words, a very considerable proportion of the energy was sold at a price less than the cost incurred to maintain the apparatus.

Taking up now the other items which add to the cost of energy, the taxes are found to be approximately 0.4 cent per kw-hr., station operation expense 0.4 cent, management 0.6 cent, and distribution 0.25 cent, making a total for these charges of 1.65 cents. Adding fixed charges as above, the total cost of the average energy alone is 3.11 cents, showing that 52.9 per cent of the energy was sold at less than cost, whereas 45.1 per cent was sold at an average of over double the cost. What proportion of it was sold below the actual cost of producing it, including operating charges, is hard to state; but unquestionably the company would have been better off if it had not delivered at least 50 per cent of the energy, particularly that to railroad and electric corporations, which unquestionably were in a position to supply energy themselves at a low price. The only reason it was supplied to them at this low price was because the business could not be obtained otherwise. In other words, the rates are fixed by the condition of getting all that the traffic will bear.

In another case it is found that the plant required approximately two-fifths more machinery in it to carry the motor load than it required in case it carried only the lighting load. The actual figures of the plant are used in determining the interest, maintenance and depreciation charges, these figures being obtained from the public service commissioners' report. The interest, maintenance and depreciation at 16 per cent, 6 per cent for interest, and 10 per cent covering maintenance and depreciation for motor service, shows $1,688,400. The total income from the motor load was $1,112,277, showing that the total income to the plant from the motor load did not equal the fixed charges on the apparatus required to produce and distribute it.

In direct contradiction to this, the lighting figures are as follows: Interest, maintenance and depreciation, $2,532,600; income, $4,575,137. In this case the lighting load paid not only all its interest, maintenance and depreciation but also the interest, maintenance and depreciation in part of the motor load and all of the operating charges on both loads.

It may be that the small lighting customers have no material reason to complain of the rates they pay for energy during lighting hours, and I personally do not feel that there is much reason for them to complain. There does, however, seem to be a reason for them to ask that they should have an opportunity to use energy for general purposes during the off-peak period at a price comparable with the lowest price paid by the motor users, because this could be done without in any way encroaching upon the peak load. By the use of a two-rate meter they could pay the lighting rate or peak rate during the peak period and the low rate during the non-peak period. The same type of meters could be used for motor customers, arranging that they too pay a low rate during the off-peak and a high rate during the peak period, this rate being such that they would pay for the interest, maintenance, depreciation, taxes and operating expenses of all kinds for the energy used during this period. Evidently this price would be exceedingly high, but as the price during the non-peak period would be low, the average price might not be high. Whether or not the average price be high is a secondary consideration, because it should be evident that the people who use energy during the peak should pay for the apparatus required at this time.

Boston, Mass. HENRY D. JACKSON.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

A Portable Pipe-Thawing Outfit

The thawing of water pipes with electrical energy taken from central-station mains has come to be a familiar practice, but it is not often that a portable power plant is employed for thawing work. Such an outfit has, however, been successfully used during the past winter by Mr. B. B. Hayford, superintendent of the water department of Waukesha, Wis. In changing the grade of certain Waukesha streets the water mains were lowered and owing to the cold weather the exposed ¾-in. service pipes promptly froze.

A traction engine was available and a 15-kw compound-wound, direct-current generator belonging to the department was mounted thereon and belted to the fly-

OUTFIT USED FOR THAWING PIPES

wheel, as shown in the accompanying illustration. This generator was wound for 115 volts, and it was realized at the outset that it would be necessary to waste a lot of energy in resistance in order to get sufficient current to perform the work. A 1.5-kw generator was therefore mounted on the engine and belted to it, and it was used to excite the shunt fields of the larger generator, which was then run at one-half its rated speed. With this combination it was possible to obtain 275 amp at a range of from 5 volts to 15 volts. Such a current would thaw out 100 ft. of 0.75-in. pipe in about twenty minutes. The saving in energy effected through using this scheme is shown by the fact that the 275 amp required to thaw the pipe when delivered at 110 volts represents 30 kw of power, while by separately exciting the fields it was possible to obtain the same current at 15 volts with a power demand of only about 4 kw. Furthermore the higher voltage had a deteriorating effect on the wiped joints of the lead goosenecks of the service pipes.

During the thawing operation one side of the circuit was connected to a fixture in the building, preferably an outside hose connection, and the other side to a hydrant on the street or to a fixture in the adjoining building. In the latter case two services could be thawed in the same time as one. The current was carried by 300 ft. of No. 0 cable, to the outer ends of which were soldered strips of sheet copper 2.5 in. wide and 10 in. long. These were wrapped around the plumbing fixtures and held in place by ordinary cabinetmaker's clamps to insure good contacts. A rheostat, a voltmeter and an ammeter were mounted on a board just under the generator.

Superintendent Hayford reports having thawed out from eighteen to twenty services a day at a cost of approximately $8.

Purchase of Oil Fuel—I

By R. T. Strohm

When it comes to the purchase of oil fuel, the buyer is interested in obtaining the greatest possible heat value for the money expended; therefore he wishes to know the amount of water, sulphur and sediment in the oil, the heat value, the flash point and the specific gravity. From a knowledge of these properties he can determine how well the oil is suited to his purposes.

The Bureau of Mines has issued a pamphlet detailing the specifications for oil purchased by the United States government and describing methods of sampling. The following information concerning the requirements of oil for fuel purposes and the methods of obtaining samples is taken largely from this publication.

The oil available for fuel may be either crude oil or fuel oil. In the first case it is simply natural petroleum as it comes from the well, and in the latter case it is the residue left after the lighter and more volatile constituents of crude oil have been driven off. In either case the oil should be homogeneous, or of uniform composition throughout. It should not be a mixture of light and heavy oils in such proportions as to give the desired specific gravity.

If it is a fuel oil—that is, has been subjected to a preliminary heat treatment—the temperature to which it was heated should not have been so high as to burn it, nor should the temperature have been so high as to cause the separation of carbon, which would afterward appear as flecks in the oil.

Flash Test

To be quite safe the oil should have a flash point of not less than 140 deg. Fahr., and this point should be determined by means of a closed tester. The flash point of an oil is the temperature at which the oil will give off vapors that will ignite when a naked flame is brought in contact with them. A crude form of test for the flash point may be made by putting a sample of oil in a cup, placing the cup in an iron vessel containing sand and applying heat to the sand so as to increase the tem-

perature of the oil gradually. At short intervals during the heating the flame of a match is passed over the surface of the oil and about ½ in. from it. Eventually a point will be reached when the gases rising from the heated oil will ignite and burn with a blue flash when the match is applied. The temperature of the oil when this action is first noticed is called the flash point.

The open cup, though forming a simple means of finding the flash point, is not accurate, because there is too much opportunity for variation in the conditions under which the test is conducted. It is very difficult to screen an open cup from all drafts and air currents, and if these are not prevented the gases rising from the oil will be diffused more or less quickly and the results will not be correct. The quantity of air in the top of the cup, just above the surface of the oil, influences the flash point. The rate at which the oil is heated will affect the result. The more rapid the heating, the more rapid the formation of gases and the lower is the flash point.

The quantity of oil also has a bearing on the result obtained. The greater the quantity of oil, the greater is the quantity of gases driven off and the lower the flash point. The form and size of the oil cup are controlling factors. The evaporation is most rapid with a large, shallow cup, and the flash point with such a cup is lower. The most nearly uniform results are to be obtained with a cup that is fairly deep in comparison with its diameter and that is filled about half full.

The flame by which the test is applied should be of constant size and shape if uniform results are desired, and the time during which it acts should always be the same. Again, its distance from the surface of the oil at the instant the test is made should not vary. The

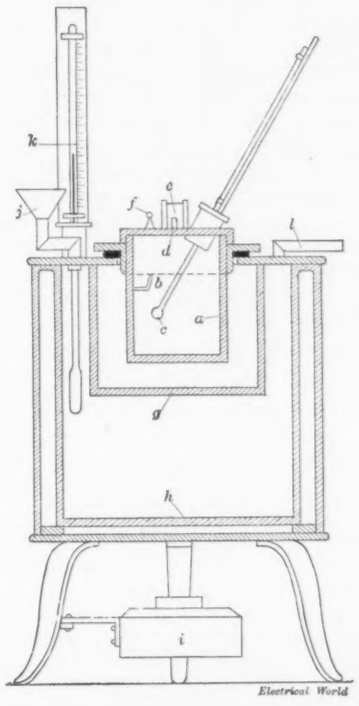


FIG. 1—DEVICE FOR TESTING FLASHING POINT OF OIL

larger the flame or the closer it is brought to the surface of the oil, the lower is the flash point. It is best to pass the flame across the center of the cup, from one edge to the other, because the mixture of gas and air is most complete at the edge of the cup.

To obtain accuracy of results and to allow the results to be compared, flash tests should be made in a closed tester, such as the Abel tester, shown in section in Fig. 1. It consists of a cup *a*, about 2 in. in diameter and 2¼ in. deep, into which the oil to be tested is poured, always to the same level, as indicated by the tip of a bent wire *b* soldered to the inside of the cup. The cover of the cup carries a thermometer *c* for registering the temperature of the oil. It also carries a slide *d*

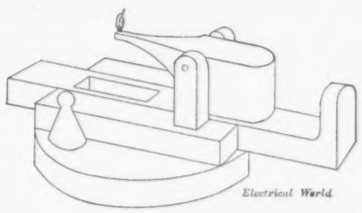


FIG. 2—LAMP FOR MAKING FLASH TEST

to which is swiveled a lamp *e* by which the flash test is made. The arrangement of the lamp on the cover of the cup is clearly shown in Fig. 2. The body of the lamp is filled with colza oil or rape oil, and at the end of the spout is a wick. In the slide is a rectangular slot, and under the slide are three slots in the cover of the cup; thus, when the slide is drawn across the cover, its slot registers with the slots in the cover. A pin projects from the slide, and when the latter is pulled out the pin tilts the narrow spout of the lamp down into the slot and thus brings the flame in contact with the gases in the cup. There is a white bead *f* (Fig. 1) fixed to the cover just opposite the flame of the test lamp, and the size of this bead is a guide to the size of the test flame to be used.

The oil to be tested is heated by a water bath contained in the copper vessels *g* and *h*. Heat is applied by the spirit lamp *i*. The water for the bath is poured into the funnel *j*, its temperature is indicated by the thermometer *k*, and the excess escapes at the overflow *l*.

To make a test, the apparatus is placed in a fairly dark place, so that the size of the test flame can easily be compared with the bead *f;* also, the flame is shielded from all air currents. The water bath is filled with water at a temperature of 130 deg. Fahr., and the oil to be tested is poured into the cup to the level of the gage wire *b*. The thermometer *c* is next inserted and the spirit lamp *i* is lighted. When the oil reaches a temperature of 66 deg. Fahr. the test flame is applied for the first time, and again after that every time the temperature of the oil has increased one degree.

To insure absolute uniformity, the test flame is applied according to the swinging of a pendulum 24 in. long, which is set up near the operator. The slide *d* is slowly drawn out while the pendulum is making three full swings in both directions and is pushed back to its original position during the fourth swing. When the vapor rising from the oil is ignited by the lamp and gives a momentary flash of blue flame, the temperature registered by the thermometer *c* should be noted. This reading is the flash point of the oil. The firing point may be determined next, if desired. It is the temperature at which the gases are given off in such quantity that they burn continuously when ignited by the test flame.

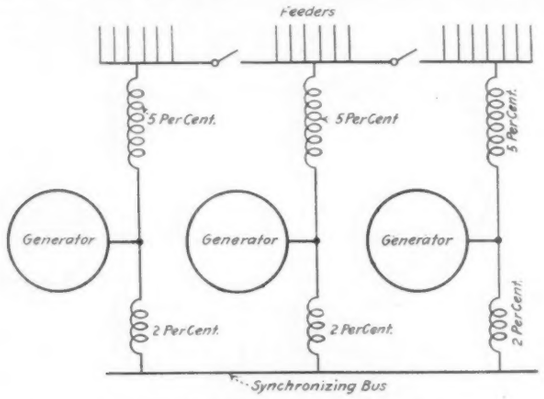
Determining Percentage of Impurities in Oil

If the oil contains water, the sample to be used for the flash test should be freed from water before being put into the tester; for as little as 1 per cent of water in oil will cause the flame to be extinguished when making a flash test.

Methods of determining the percentage of water in oil and of taking samples will be described in a later issue of the *Electrical World.*

Connection of Reactors

Bus-tie, generator and feeder reactors, despite their limitations, have been advocated in varying degrees, but the arrangement of reactors shown herewith apparently combines the advantages of the former schemes and has few of their objectionable features. The feeders are



ARRANGEMENT OF REACTORS

grouped and fed from different bus sections which are individually energized by generators delivering current through 5 per cent reactors. The bus sections are normally operated separately but may be instantly connected by tie switches. To permit this emergency connection, each generator in operation is permanently connected to a common synchronizing bus through 2 per cent reactors which keep the generators in step and also serve the purpose of bus-tie reactors. When this scheme is employed with a bus divided into several sections the voltage regulation is much better when there is current exchange than when ordinary bus-tie reactors are used. This is obvious from the fact that to get the same protection as here obtained 5 per cent bus-tie reactors would have to be used and the energy exchanged between two non-adjacent sections would suffer a large voltage drop. If it is not considered necessary to protect the generators themselves against current surges, the 5 per cent reactors can be omitted and the operation still considerably improved over that obtained with bus-tie reactors. This scheme was described by Mr. H. G. Stott, of the Interborough Rapid Transit Company, New York, at the recent A. I. E. E. meeting.

Increased Production with Electric Braking Control

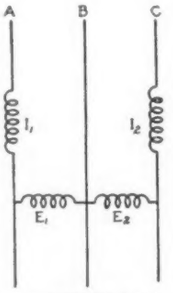
In a paper entitled "Electrical Aids to Production in Factories," presented by Mr. H. E. Eastwood, Cleveland, Ohio, at a recent meeting of the Detroit-Ann Arbor Section, A. I. E. E., the author pointed out the fact that dynamic braking and automatic control of machine-tool motors will safeguard the lives of workmen and increase the output of machine shops considerably. On lathes, planers, shapers, etc., operating at high speed where frequent stops have to be made to adjust the cutting tools, increases of 45 per cent in production have been obtained by employing automatic motor control. This figure of increased production was estimated from the number of pounds of chips which were removed per horse-power per minute. The speaker also described in detail a scheme for simultaneously braking all the machines on a group-drive system in case of emergency. Conveniently placed push-buttons operating a dynamic brake on the motor are installed on each machine so that if an attendant observes an impending accident he may prevent serious injury or even loss of life by pushing the nearest button. This device, it is said, will stop all of the machines in half a second without shearing the motor or the connecting shafts.

Fluctuating Synchronous Motor Load Affects Relative Meter Readings

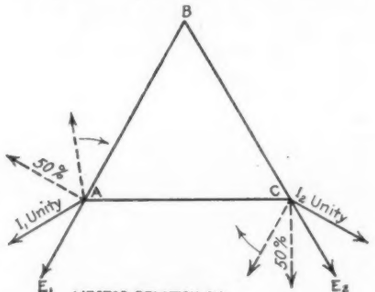
What changes the ratio between the readings of two single-phase wattmeters when measuring the power delivered to a synchronous motor operating at a greatly fluctuating load? Will you also explain what causes similar ratio changes in the instrument readings when the motor-field excitation is changed? L. C. T.

By observing characteristic curves taken from synchronous motors you will note that the power-factor ordinarily takes a sharp drop below half load. The motor you refer to is probably working below the knee of this curve at times, thus causing a considerable variation in power-factor as indicated by the changing ratio of your wattmeter readings. When the motor field is excited above normal the power-factor will at fluctuating loads alternately become leading or lagging, this depending on the load. A vector diagram explaining this phenomenon of synchronous motors is shown in the "Standard Handbook for Electrical Engineers." Changing the field excitation will also cause a change in the power-factor and a corresponding change in the ratio of the instrument readings. At 50 per cent power-factor one meter will read zero and the other give the total power delivered. Below this power-factor one meter reads negative and the other positive. Above 50 per cent the readings will both be positive but differ until unity power-factor is reached. With the two-wattmeter method of measuring three-phase power the algebraic sum of the readings always represents the total power delivered.

The changing ratio of meter readings is best explained by the accompanying vector diagram. The sides of the triangle represent the phase relation of the emf across each phase and also the current flowing in each leg at unity power-factor. In the two-wattmeter method the potential and current coils are connected as shown in the diagram. At unity power-factor the currents flowing through wattmeters W_1 and W_2 will be equal and are represented by vectors I_1 and I_2. The emfs measured by the wattmeters are also equal and are represented by E_1 and E_2. The power in each case is the product of E and the component of I in phase



2 WATTMETER COIL CONNECTIONS FOR MEASURING 3-PHASE POWER



VECTOR RELATION OF CURRENTS AND E.M.F'S AT UNITY, 50 PER CENT AND LOWER POWER FACTORS

GRAPHICAL EXPLANATION FOR DIFFERENT METER READINGS WITH TWO-WATTMETER POWER MEASUREMENT

with it. When the current in each leg has changed its phase relation with the emf by 60 deg., corresponding to a power-factor of 50 per cent, the current component in phase with E_2 is zero, hence that meter reads zero. Further reduction in power-factor causes the component of I_2 to become negative, thus causing a negative reading on wattmeter W_2.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Iron for Electrical Construction.—A note on a recent British patent (No. 3445, 1913) of W. Rübel. In this iron the eddy-current and hysteresis losses are small and the iron itself is soft and can be rolled without breaking. The material, which, it is said, is cheap to manufacture, is obtained by the addition to iron, containing less than 0.5 per cent impurities, of an amount of aluminum and silicon not exceeding 3 per cent of the alloy. Of this total the aluminum represents between 1.3 and 2 per cent, and the silicon between 0.8 and 2 per cent. Boron may be substituted for the silicon, and beryllium or calcium for the aluminum.—London *Elec. Eng.*, Feb. 26, 1914.

Calculation of Direct-Current Machines.—L. ISAMBERT.—A mathematical paper, illustrated by diagrams, in which the author points out that, besides the methods of direct-current machine calculation which permit computing the value of the magnetomotive forces of the teeth of the armature, it is interesting to know a graphical construction which gives directly the actual induction of the corresponding magnetomotive forces in ampere turns per centimeter.—*La Lumière Elec.*, Feb. 28, 1914.

Cascade Induction Motor.—L. J. HUNT.—A paper read before the (British) Institution of Electrical Engineers in Leeds, giving a detailed illustrated description of the author's cascade induction motor and its operation.—London *Elec. Review*, Feb. 27, 1914.

High-Tension Insulation.—A. MATTHIAS.—An illustrated article on high-tension insulation construction, with special reference to transformer design.—*A. E. G. Zeit.*, February, 1914.

Starting Squirrel-Cage Motors.—E. JACKSON.—An illustrated article describing the following five methods of starting squirrel-cage induction motors—direct-starting, auto-transformer starting, star-delta starting, resistance starting and starting with generator.—London *Elec. Review*, Feb. 20, 1914.

Lamps and Lighting

Electric Lighting.—A symposium of papers on electric lighting. W. R. Whitney and E. P. Hyde discuss the general problem of light production, C. P. Steinmetz the efficiency of illuminants, Dushman modern theories of light, and Elihu Thomson the spectroscope. Then follow articles by J. B. McCall, J. W. Lieb, Jr., C. W. Stone, H. R. Summerhayes, R. H. Tapscott, L. B. Bonnett, J. R. Crouse, S. E. Doane, J. R. Werth, E. P. Edwards, J. E. Kearns and C. M. Green, on different subjects of generation and distribution. Next come contributions by L. A. Hawkins, E. Wintraub, J. W. Howell, E. J. Edwards, J. E. Randall, S. H. Blake, C. A. B. Halvorsen and I. Langmuir on various lamps, including the "half-watt" tungsten lamp, the quartz-tube mercury-arc lamp, the gas-filled tungsten lamp, the magnetite arc, etc. The symposium is concluded by articles by L. Bell, W. C. Allen, G. N. Chamberlain, G. H. Stickney, A. L. Powell, M. Luckiesh and W. D'A. Ryan on such subjects of illumination as tendencies in street lighting, ornamental lighting, interior illumination, etc.—*Gen. Electric Review*, March, 1914.

Manufacture of Tungsten for Drawn-Wire Filaments.—A note on a recent British patent of the British-Thomson-Houston Company and the General Electric Company of this country (No. 1915, 1913). This is an improvement on the method of preventing "offsetting" when the filaments are used on alternating current, described in Patent No. 184,670, 1911. The solution of a rare-earth compound is incorporated with the tungsten oxide or compound from which the powder for use in the production of drawn filaments is to be produced. The mixture is heated in an oxidizing atmosphere and then reduced. A particular method consists in the use of a solution of thorium nitrate.—London *Elec. Eng.*, Feb. 26, 1914.

Miners' Electric Lamps.—F. J. TURQUAND.—A long abstract of a paper read before the London branch of the Association of Mining Electrical Engineers. The author first discusses the design of miners' lamps with respect to the three following points: first, the shell or case; second, the battery, and, third, the methods of mechanically and electrically connecting the lamp to the case containing the electric bulb with the battery, including the locking device. In the second part of the article the author deals with the maintenance of miners' electric lamps.—London *Electrician*, Feb. 20, 1914.

Train Lighting.—T. FERGUSON.—A long abstract of a paper read before the Manchester Section of the (British) Institution of Electrical Engineers. The author gives a table of twelve different electric train-lighting systems, the principal distinguishing features of the different systems being clearly tabulated. An account of the extended discussion which followed is also reproduced.—London *Electrician*, Feb. 20, 1914.

Water Model of the Musical Electric Arc.—W. DUDDELL.—An abstract of a (British) Physical Society paper. In the model the arc is represented by a mushroom valve. The pressure of the valve on its seat is so arranged that the pressure tending to reseat the valve diminishes very rapidly as the valve lifts. Water is admitted beneath the valve, flows through the valve into the vessel which contains it, and overflows. In order to indicate the difference of pressure on the two sides of the valve (which represents the arc) a glass pressure column is introduced into the pipe leading to the valve and quite close to it. As the water overflows freely from the tank in which the valve is immersed, the pressure on this side of the valve may be taken as the zero of reference, and consequently the height of the water column in the pressure tube above or below the level of the overflow gives the pressure underneath the valve. If water be admitted below the valve, the pressure in the pressure tube rises to a high value; finally the valve lifts—i.e., the arc is struck—but the pressure still remains high. If, however, the flow of water is increased, the valve will open considerably and the pressure below it will decrease. If nicely adjusted, this effect can be made to take place over a considerable range. If instead of connecting a pressure tube of small bore to indicate the pressure on the underneath side of the valve a large-diameter tube be introduced so that the water column in it has a periodic time of its own and is able to oscillate similarly to a condenser circuit shunting the

arc, oscillations will be set up in this column, and if the periodic time of the liquid in this column be altered, the period of the oscillations will be altered. This effect can easily be obtained by connecting air vessels of different capacities to the open end of the tube, in this way altering the controlling force acting on the water, or, in other words, altering the capacity of the circuit shunting the arc. With such a water model a great many of the properties of arcs, both intermittent and oscillating, can easily be shown. The one point of difficulty in constructing the model is to obtain a force acting on the valve which decreases rapidly when the valve lifts and which occasions no friction. So far the only successful method which the author has tried is to hang from the underneath side of the valve a piece of soft iron which nearly touches the pole of a small electromagnet. This gives a force which without interposing any friction rapidly decreases as the valve lifts, and works very well.—London *Electrician*, Feb. 27, 1914.

Determination of the Color of Light.—L. Bloch.—An illustrated English translation in abstract of his German paper recently noticed in the Digest. The author has three color screens, after the method of Ives, and compares the red, green and blue so obtained with those of daylight through the intermediary of a tungsten lamp as a standard. A large number of results are given.—London *Electrician*, Feb. 27, 1914.

Pentane Lamp as a Working Standard.—E. C. Crittenden and A. H. Taylor.—A paper in which the authors describe fully the method of testing pentane lamps at the Bureau of Standards, give brief general directions for the use of the lamps, discuss more fully the question of fuel, and furnish data on the effects of pressure and moisture in a form which may be useful for those who have occasion to reduce observations on flames to normal candle-power values.—*Scientific Papers, Bureau of Standards*, No. 216.

German Illuminating Engineering Society.—A report of a recent meeting in which Bode spoke on the evolution of incandescent gas lighting, Norden discussed the definition and calculation of the diffusion of any system of lighting, and Klebert described light sources for marine purposes.—*Zeit. f. Beleucht.*, Feb. 28, 1914.

Traction

Electrified Mountain Railway in Japan.—An illustrated article on the electrification of the Usui-Tage mountain railway in Japan, which was formerly operated by steam, but for which twelve direct-current gear-and-pinion locomotives have now been provided. The power plant contains three 1000-kw turbo-generators producing three-phase energy at 6600 volts and fifty cycles. The voltage is reduced in two substations to 240 volts alternating current and then changed to 650-volt direct current by synchronous converters. Energy is supplied to the locomotives by means of a third-rail.—*A. E. G. Zeit.*, February, 1914.

Suburban Railroad of Stockholm.—F. F. von Holmgren.—The first part of an illustrated article on the electrification of the suburban railroad from Stockholm to Saltsjöbaden. The 600-hp motor-car equipment and the line construction are described, as well as the converter station which produces 1350-volt direct current. Results obtained during the first half year of operation are also discussed. The paper is to be concluded.—*Elek. Zeit.*, Feb. 26, 1914.

Rail Corrugation.—S. P. W. Sellon.—An abstract of a paper read before the (British) Institution of Civil Engineers. The author believes that rail corrugation can be avoided with hard rails containing a high proportion of carbon (more than 0.55 per cent) and also a high proportion of silicon. He also suggests that the essential points to be specified are mechanical properties corresponding with the working stresses imposed upon the rails and compressive strength. The whole specification of the rail in respect to its mechanical qualities should be a direct relation to the stresses which it will be called upon to resist.—London *Electrician*, Feb. 27, 1914.

Electric Locomotives.—F. Lydall.—The first part of an illustrated paper read before the (British) Institution of Electrical Engineers on motors and control equipments for electric locomotives. The question of motor capacity in relation to certain characteristics of the locomotive is touched upon, and the influence of the weight of the locomotive and the conditions of service upon the design of the control equipment is considered by means of an example. Various systems of control are dealt with, and the author discusses from a practical standpoint the design of the resistance grids, contactors, reversers, circuit-breakers, apparatus for automatic working and induction regulators.—London *Electrician*, Feb. 27, 1914.

Installations, Systems and Appliances

Standardization of Frequencies.—C. W. Stone.—The author points out that there are as many as five different frequencies in use in this country to-day, although there has never been an excuse for more than two of them, twenty-five and sixty cycles. The latter frequency possesses decided advantages for incandescent and arc-lighting circuits and affords the manufacturer a greater range of speed and a more economical design for his generators and motors. The lower frequency was justified a number of years ago, when the operation of synchronous converters on sixty-cycle circuits was far from satisfactory; but now that these machines have been improved to the point where their performance is entirely successful at the higher frequency, it would seem that all parties concerned—the public, the operating companies and the manufacturers—would be benefited by the gradual adoption of sixty cycles as standard.—*Gen. Elec. Review*, March, 1914.

Electric Cooking.—F. S. Grogan.—A paper read before the Wolverhampton and District Engineering Society on "The Cooking Problem—Why Electricity Is Winning." The following advantages of electric cooking are discussed in detail: Perfect cleanliness; simplicity and convenience of operation; actual monetary saving owing to reduced loss in weight when cooking food (the saving effected being not only water but also nutritive food stuffs of proteid and fat, which latter increase the digestibility of the cooked food by the presence of the extractives and juices); absolute safety, and the absence of fumes. Figures of cost are given and compared with those for gas cooking.—London *Electrician*, Feb. 27, 1914.

Electrophysics and Magnetism

Cathode Disintegration in a Vacuum Tube.—A. M. Tyndall and H. G. Hughes.—The disintegration or "spluttering" of the cathode in a vacuum tube has been the subject of much investigation. In the present paper an account is given of some experiments on the influence of certain factors on this disintegration. These are the duration of the discharge, the previous history of the cathode, the pressure and nature of the gas, the current density, and the cathode fall of potential. Provided that a constant cathode-fall is maintained, the following three losses hold good: First, considerable changes in pressure have no influence on the amount of disintegration for a given current and duration of discharge. Second, new and old cathodes of the same area disintegrate practically to the same extent under the same conditions of current and duration of discharge. Third, the rate of disintegration for

a given current density is constant throughout discharge. Thus it is not affected by the removal of gases from the surface of the cathode by previous discharge. The influence of the cathode-fall of potential on the rate of disintegration was investigated at low values of the cathode-fall. No simple relationship (such as exists at high values) was observed. The rate of disintegration appears to vanish at the normal cathode-fall. The linear relationship which exists between current density and rate of disintegration at small current densities and high cathode-falls does not hold in the general case. Preliminary work on the influence of the nature of the gas shows that at low values of cathode-fall there is no appreciable difference between the rates of disintegration in hydrogen and air under similar conditions. Certain theoretical considerations are advanced in connection with the results.—*Philos. Mag.*, March, 1914.

Eutectoid Transition Point of Carbon Steels.—S. W. J. SMITH AND J. GUILD.—A note on a recent paper presented before the Royal Society in London. The magnetic properties point at temperatures near the eutectoid transition point deserve further examination. Simultaneous observations of intensity of magnetization and of temperature were made over various ranges of heating and of cooling in different magnetic fields. Nine steels containing proportions of carbon ranging between 0.1 and 0.5 per cent were used. Each steel contained about 0.2 per cent or less of silicon and manganese. It was found that the temperature corresponding with the beginning of the transformation of the eutectoid during heating could be fixed within + 1 deg. C. under suitable conditions. This temperature was 735 deg. C. as read by the thermometers used, although these were better adapted for comparative measurements than for determination of absolute value. It was the same for all the steels.—London *Electrician*, Feb. 20, 1914.

Units, Measurements and Instruments

High-Frequency Ammeters.—J. H. DELLINGER.—An account of a long experimental investigation of reliable ammeters for high-frequency work. The circuit within a high-frequency ammeter must be of as simple form as possible. This requirement is best fulfilled by a single straight wire of very small diameter, and no other arrangement can be taken as *a priori* reliable at all frequencies. The heat production is readily measured in any form of circuit, and in consequence all successful ammeters for high-frequency use utilize the thermal effect. The thermometric means of measuring the heat production, whether expansion, calorimetric effect, resistance or thermal emf, do not affect the accuracy. Two similar wires in parallel, the integrated heat production in the whole being measured, constitute a system nearly as reliable as a single wire. With such a system immersed in an oil bath currents up to 10 amp can be measured. For larger currents other combinations of current elements are necessary, and a great variety of ammeters have been developed and studied experimentally and theoretically in this investigation. Experimental instruments and commercial instruments of three different companies were included. All the types in use are subject to errors when used at the frequencies of radiotelegraphy, the errors being in some cases very large. In some the readings increase with increase of frequency and in others they decrease. In most cases the design can be so changed as to eliminate the errors. The current in a conducting circuit has no meaning for extremely high frequencies; for in any circuit above a certain high frequency the capacity between parts of the circuit and of auxiliary apparatus is so important that an appreciable fraction of the current is shunted through the dielectric and the current is of different amount in different parts of the wire circuit. The changes of current distribution in the instruments whose working parts were of low-resistivity metal all occurred in about the range of radiotelegraphic frequencies, 100,000 cycles to 1,500,000 cycles. That is, the current distribution was constant for frequencies from 0 up to about 100,000, then underwent changes and became constant at different values for frequencies above about 1,500,000 cycles. An approximate experimental method for investigation of the current distribution in thin strips at high frequency has been devised and is used to obtain qualitative results. Most of the errors of commonly used high-frequency ammeters are found to be due to mutual inductances or to self-inductance of parts, which had been supposed negligible. The use of high-resistance metals in the working parts, and the design of the latter with very small cross-sections, eliminates errors in most cases. The location of the current leads is of great importance, particularly in the so-called unshunted ammeter, determining whether the error shall be large or inappreciable.—*Bulletin Bureau of Standards*, Jan. 15, 1914.

Determining Ballistic Constant of Moving-Coil Galvanometer.—PAUL E. KLOPSTEG.—An abstract of an American Physical Society paper. From the equation for damped periodic motion of a galvanometer coil, expressing the condition for the discharge of a quantity Q of electricity through the coil at rest, the value of the first maximum displacement is found by the usual method of differentiation. This value represents the ballistic throw of the slightly damped galvanometer. From the expression so found the equation for the ballistic constant is obtained. In the transformation a substitution is made which is based upon the equation for the damped-coil method of measuring the magnetic field. The resulting expression is

$$K_1 = \pi \sqrt{\frac{I_0 \ \varepsilon^l}{10^7 R T_0 \ (L - l)}}$$

the value of K_1 being equal to the number of coulombs per radian. I_0 is the moment of inertia of the coil, T its period, l its logarithmic decrement on open circuit and L its logarithmic decrement with R ohms in the galvanometer circuit. When the value of l is about 2.5 per cent of π, the value of K_1 is too large by 0.1 per cent, the difference increasing as l grows larger. The following more exact formula may then be used:

$$K_2 = \varepsilon^{(\lambda/\pi)\tan^{-1}(\pi/\lambda)} \sqrt{\frac{I_0}{10^7 R T_0} \frac{\pi^2 - l^2}{L - l}}$$

An explanation is offered for the frequently observed difference between the values of the ballistic constant in a given instrument with a strip or ribbon upper suspension on the two sides, A and B, of the scale. This difference is due principally to a certain amount of torsion in the lower suspension which necessitates a corresponding amount of "counter torsion" in the upper suspension in order to keep the coil in the position of the null reading. The effect of torsion in a strip suspension is to shorten it, the case resembling that of a bifilar suspension for angles less than 180 deg. For a throw in one direction, say A, the coil must be raised; in the opposite direction the turning moment of the force of gravity acts in the same direction as the electromagnetic torque. Consequently, with a given quantity of electricity the throw in the direction B is greater than in the direction A. The same "bifilar effect" introduces an error into the determination of I_0 of a coil by the comparison of vibrations method when a strip is used as the suspension fiber, unless the masses of the coil and of the comparison disk, as well as their amplitudes, are the same. The error due to this effect becomes negligible if a wire of circular cross-section is used as the suspension fiber.—*Phys. Review*, February, 1914.

Telegraphy, Telephony and Signals

Time of Calls Through Odense Exchange, Denmark.—J. von Linstow.—An illustrated description is given of the means employed of measuring the answering time (the time elapsing from the moment a subscriber calls his central office until the operator answers), and the author then discusses mathematically the effect of calls coming in before the previous call is answered. A formula is deduced for an ideal answering time by means of which the respective service given by operators can be compared.—London *Electrician*, Feb. 27, 1914.

Long-Distance Exchange.—W. Schreiber.—The first part of an illustrated description of the new long-distance central office in Munich, which is the first European exchange of the kind operating in connection with automatic exchanges. Some of the new features are a semi-automatic long-distance connection system and the automatic distribution of calls with manual reserve, etc.—*Elek. Zeit.*, Feb. 26, 1914.

Improving Telephone Service.—W. Aitken.—An illustrated paper read before the (British) Institution of Electrical Engineers at Newcastle. The author describes a number of methods which he suggests for increasing the efficiency of the telephone service. These take the form of automatic or semi-automatic devices intended to assist the operator in her work and to eradicate such faults as charging for service that has not been given, operating mistakes, wrongly reporting lines engaged, and premature severing of connections.—London *Electrician*, Feb. 27, 1914.

Automatic Telephones.—A long, illustrated description of the automatic telephone clock and indicator systems in use in King's College Hospital in London.—London *Electrician*, Feb. 27, 1914.

Wireless Telegraphy.—J. Reyval.—Some illustrated notes on wireless telegraphy service in the Tchad district of the French Congo in Africa.—*La Lumière Elec.*, Feb. 28, 1914.

Wireless Telegraphy.—L. B. Turner.—A letter criticising some points in A. S. Blatterman's recent paper on the calculation and design of a wireless-telegraph transmitting station.—London *Electrician*, Feb. 27, 1914.

Book Reviews

Gas Power. By C. F. Hirshfeld and T. C. Ulbricht. New York: John Wiley & Sons. 210 pages, illus. Price, $1.25.

A handy volume, treating of the internal-combustion engine in a simple manner. Although it may well serve as an introduction to more advanced works on the subject, it should not be classed among the "primers" or elementary books. The principles of operation are clearly explained, and the illustrations and diagrams are clear and instructive. Introduction of mathematics has been avoided as far as possible. Without giving a complete list of the various chapters, it may be said that the topics covered include a comparison and classification of fuels, the historical development of the internal-combustion engine, four-stroke and two-stroke cycles, classification and description of modern gas and gasoline engines, methods of cooling, governing, ignition, carburetors, and in fact all that is necessary to give the reader a good insight and working knowledge of gas power in its various forms. The illustrations are numerous, and the line drawings, which show the essentials without including a mass of unnecessary detail, are well reproduced. The photographic illustrations, which do not always add to the value of a technical book, are few, but they are above the average in quality and have been carefully selected. The book should prove very useful to students and engineers desiring a working knowledge of this class of engines.

Electrical and Magnetic Calculations. By A. A. Atkinson. New York: D. Van Nostrand Company. 310 pages, illus. Price, $1.50.

An excellent textbook and drill book for use in electrical engineering classes, based upon arithmetical applications. We believe in this method and consider it to be of the greatest practical utility. The minimum amount of explanatory text is inserted for the elucidation of the principles dealt with arithmetically. This is what such a textbook ought to be. Of course, it may be contended that a student could study in such a textbook how to work out numerical problems without having any sufficient idea of the underlying principles involved. A reply to this objection is, first, that a student who can correctly work out such problems is at least a useful man to his employer, and, second, that a student who would be content merely to study engineering arithmetic without ambition to learn the underlying physical principles would probably be a man upon whom it would be waste of energy to lavish physical instruction. The subjects dealt with in the volume can be gleaned from the titles of the successive chapters, namely: Explanation of units; relation of quantities; general laws of resistance; electrical energy; wiring for light and power; batteries; magnetism; relation of magnetic quantities; the emf of dynamos and motors; calculation of fields; elements of dynamo design; alternating current, and alternating-current distribution. The book has marked merit, as is also indicated by the fact that this is its fourth edition.

Conservation of Water. By Walter McCulloh. New York: Yale University Press. 99 pages, illus. Price, $2.

This is a collection of the Chester S. Lyman lectures delivered by the author in 1912 before the senior class of the Sheffield Scientific School, Yale University. The Chester S. Lyman Lectureship Fund was established in 1910 for the purpose of maintaining a course of lectures on the subject of water-storage conservation. This book is the first of the series of memorial lectures. The ground covered includes a review of the data essential to the comprehensive study of water storage, water-power developments in the United States, especially in regard to the amount developed as compared with the available power; water storage for town supplies and irrigation, and a special study of the water resources of New York State. Much useful information is collected for easy reference, thus obviating the necessity of turning to many scattered sources of information, including the government publications. It must not be supposed, however, that these lectures are merely a statement of facts more or less easily ascertained. The author has taken pains to treat his subject in such a manner as not only to instruct his audience but also to emphasize in the right place those facts and considerations regarding the conservation of our natural resources which are not only of engineering interest but also of national importance. The statistics given, and especially the illustrations and diagrams showing in the clearest possible manner the undeveloped water-power, the waste due to absence of storage reservoirs and the waste due to leaks and carelessness on city water supplies, are of the greatest interest and deserve close study. The value of the book is also greatly enhanced by the fine whole-page reproductions of photographs showing the river and reservoir conditions at many points of interest.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Sectional-Type Control Desks

Where economy of space is an important consideration a control desk may often be used to advantage for the mounting of control apparatus. Standard control desks are sectional in form, each section being a unit

FIG. 1—PLAIN CONTROL DESK

in itself corresponding to the panels of a switchboard.

The desks illustrated herewith are built up on a pipe framework having a channel-iron base. They are designed so that sections can be easily added to an exist-

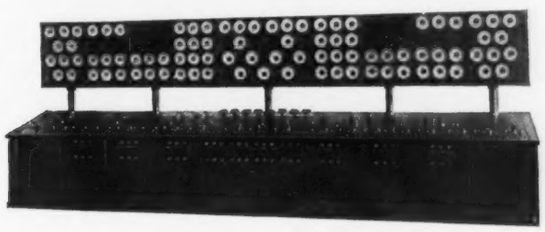


FIG. 2—CONTROL DESK WITH INSTRUMENT FRAME MOUNTED ON POSTS

ing desk by moving one or both end sections and without disturbing the apparatus already installed. The top sections are of slate and the sides are of steel. Black marine finish is used for both the top and sides

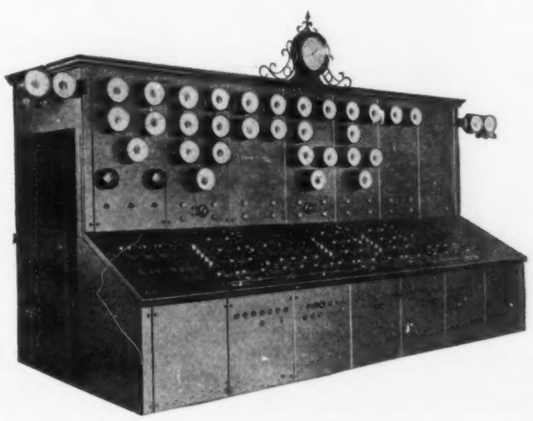


FIG. 3—CONTROL DESK WITH SPECIAL REAR INCLOSURE

to correspond with the standard finish of the controlling devices and indicators. Access to the desk for wiring is obtained from either the rear or sides by means of cover plates which can be easily removed.

Fig. 1 shows a plain desk having no provision for instruments. This type may be placed in any convenient part of the station and still permit of an uninterrupted view. Instruments are generally mounted on a supplementary panel switchboard or on instrument posts or frames to suit local conditions.

Fig. 2 shows another type of desk which has an instrument frame mounted on posts. The frame is supported at a height which permits of a view of the station floor. The instrument frame is also of pipe construction with slate panel sections of widths to correspond with those of the desk top. The posts supporting the frame are hollow, and the instrument leads are brought up through them from the desk below. A section of the desk includes a section of the instrument frame.

A third type of desk, illustrated in Fig. 3, has an instrument section extending upward from the rear edge of the desk top, without intervening space. A section of the desk includes a corresponding instrument section. This type is commonly combined with a panel switchboard.

The desks described above are built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Instrument for Testing Magnetos on Automobiles

A device for testing the magnetos used on Ford automobiles is manufactured by the Hoyt Electrical Instrument Works, Pennacook, N. H., and is connected permanently in the circuit so that it will show the strength of the magneto at all times when running. This magnetometer is 2 in. in diameter.

DEVICE FOR TESTING AUTOMOBILE MAGNETOS

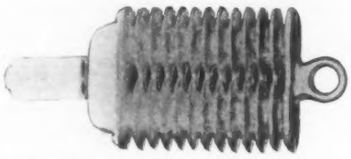
After a series of tests made on Ford cars of all ages under different operating conditions it was found that almost invariably there was a point at which the magneto, although generating, did not satisfactorily ignite the charge at all times. This point was indicated on the scale in the illustration as *P*, meaning "poor." At still another point the magneto, while operating without skipping, ignited the charge so slowly that there was an appreciable lack of power. This was indicated on the scale as *M*, meaning "medium." The lowest points at which efficient ignition took place were designated as *G* for "good" and *E* for "excellent."

The magnetometer is located at a point on the dashboard where it can be most conveniently observed by the driver. At the same time, for the sake of appearance, it is so placed that the terminals extend through the dashboard under the hood, rather than above it.

The magnetometer is secured in position by mounting it on two studs placed in 3/16-in. holes drilled in the dashboard and placing a nut and washer on each stud. A cable is attached to each stud, one being connected to the insulated plug in the top of the magneto which conveys the energy to the coil and the other being grounded to the transmission case.

Automobile Radiator Heater

The appliance department of the Edison Electric Illuminating Company of Boston has recently brought out an electric heater to prevent automobile radiators from freezing and bursting in cold weather. The device consists of a ribbed casing which contains standard General Electric heating units rated at 180 watts. The casing is made of either aluminum or cast iron and is provided with a hook support and an electric plug connector. Its energy consumption is low so the device may be connected to any electric-lamp socket.

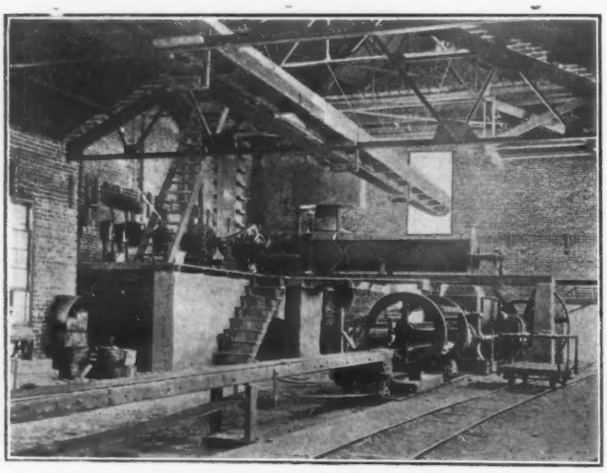


AUTOMOBILE HEATER

Electric Drive in a Brick Plant

The brick plant of Mr. L. I. Stevenson, situated about 12 miles from Birmingham, Ala., represents all that is modern and efficient in equipment and layout. The machinery is all motor-driven, energy being purchased from the Alabama Power Company. The kilns are operated on the waste-heat system.

The plant has an output of 10,000 bricks per hour, the product being common red-shale and Oriental brick.



INTERIOR VIEW OF BRICK PLANT

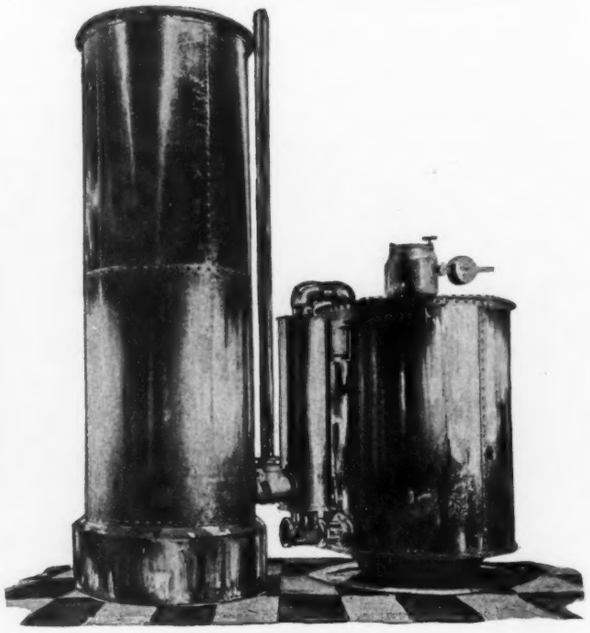
Shale is mined at a point several hundred feet from the plant and is hauled by cars which are pulled up the slope by a 50-hp motor. The shale is first sent to a crusher, driven by a 30-hp motor, and is then passed through either pulverizers or dry pans, depending on its condition. A tripper conveyor finally distributes the material over a 100-ft. storage space.

The pug mill is driven by a 50-hp motor and the combination brick machine by a 125-hp motor. The illustration shows these two machines. An electrically driven transfer car conveys the brick from the drier to the kilns, of which there are sixteen, each having a capacity of 70,000 bricks. Three motor-driven fans are used to provide draft, circulation and exhaust for the kilns. Energy is received at 22,000 volts and is stepped down to 550 volts for the motors and to 110 volts for lighting. A two-panel switchboard equipped with oil circuit-breakers protects and controls the various circuits.

The electrical equipment, except the hoist motor and transfer car, was supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Gas Producer

The gas-producing plant shown herewith operates on the suction-gas principle, no more gas being generated than the amount required by the engine. If the load is heavy, the supply of gas is increased; if it becomes light, the supply is decreased. Pea anthracite coal is the fuel used. The method of starting the plant is quite as simple and almost exactly similar to lighting a closed stove. After the producer has been charged and lighted a small fan or blower is used at first to create a draft, the heated air and smoke passing away to the outside atmosphere. On their way, however, this heated air and smoke are brought in contact with the water-jacket head of the producer and thence go through an evaporator. In this way the necessary supply of moist and steamed air is provided, which can be drawn through the incandescent fuel in the producer on the first suction stroke of the engine. After ten or fifteen minutes of blowing with the fan the gas is diverted to the engine by operating a valve and the engine is started in the usual way, after which the producer or gas-generating plant requires practically no more attention for several hours.



GAS-GENERATING PLANT

This producer is the product of the Jacobsen Gas Engine Company, Saratoga Springs, N. Y.

Pneumatic Recording Tachometer

A recording tachometer whose principle of operation depends on the centrifugal action of air in a revolving cylinder which is connected to a recording device through a line of flexible tubing has been developed by the Bristol Company, Waterbury, Conn. Fig.

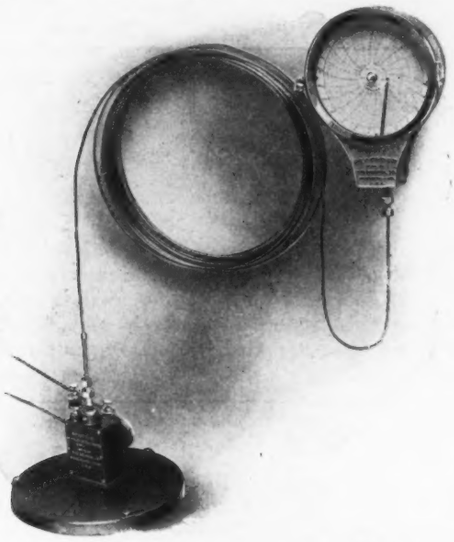


FIG. 1—RECORDING APPARATUS COMPLETE

1 shows the complete apparatus. Fig. 2 illustrates diagrammatically the construction of the revolving mechanism. Here *B* designates a hollow circular protecting base with a bearing at its upper surface for supporting the hollow shaft *D*. This shaft is rotated by means of a belt and pulley or a sprocket and chain connected to the shaft whose revolutions are to be measured and recorded.

The lower end of the hollow shaft *D* terminates in a horizontal tube *A* which is open at its extremities. The upper end of the shaft *D* is surrounded by a casing *E*. This casing is partly filled with oil and the free end of another tube *F* extends into it. The tube *F* is sta-

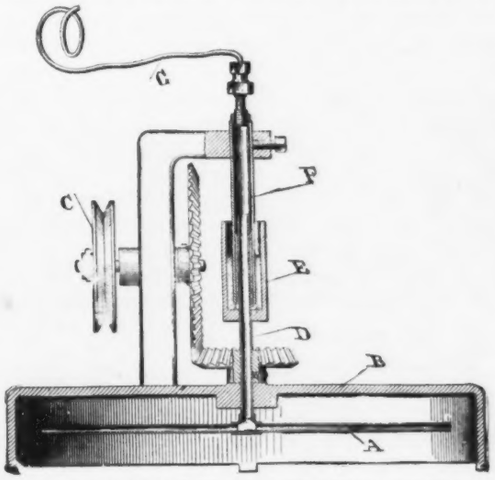


FIG. 2—CONSTRUCTION OF REVOLVING MECHANISM

tionary and it is joined at its outer end to the flexible capillary tubing *G* leading to the recording device. The latter is equipped with a low-range recording vacuum gage. This recording instrument may be installed either near to or at a distance from the shaft the speed of which is to be recorded, and flexible copper tubing connects the recorder with the cylinder.

Miniature Display Sign

A miniature section display sign is shown herewith any letter of which can be replaced without disturbing the others. A feature of the sign is that the burning out of a lamp in any of the letters will not affect the brilliancy of any of the others in the sign. The letters,

SECTIONAL DISPLAY SIGN

which are made of aluminum castings 3.5 in. high, contain white-enameled channels in which special miniature 4-volt tungsten lamps are recessed. The sections are plugged together in series and set in a tray as shown. Each section requires 15 watts. The trays are made to accommodate three, six and nine-letter signs, the longest being 31.5 in. These signs are designed to operate on 100-volt to 125-volt direct-current or alternating-current circuits. They are manufactured by Harvey Deschere, 50 Church Street, New York City.

Elevated-Oven Ranges

The Simplex Heating Company, Cambridge, Mass., is putting on the market several elevated-oven ranges of different sizes suitable for families of from four to ten persons. The range shown in the accompanying

LARGE-SIZED RANGE WITH ELEVATED OVEN

illustration is designed for use in families having eight to ten members. It is 24 in. wide and without the utensils has a maximum height of 36 in. Its maximum output is 4150 watts.

This range has an oven 15 in. wide, 18 in. deep and 11.5 in. high inside and a plate-warming compartment 15 in. wide, 15 in. deep and 7 in. high inside. It is

equipped with one 9-in. by 12-in. broiler with griddle top, two 6-in. disk stoves, two 8-in. disk stoves, one three-point blazer for one of the 6-in. stoves, one three-point double boiler (porcelain food vessel) for one of the 6-in. stoves, one 5-qt. vegetable boiler for one of the 8-in. stoves, one 4-qt. tea kettle for one of the 8-in. stoves, one green signal lamp on the plate warmer and one red signal lamp on the main circuit.

Engine-Driven Three-Wire Direct-Current Generators

Three-wire direct-current generators of the commutating-pole type recently placed on the market by the General Electric Company, Schenectady, N. Y., are built

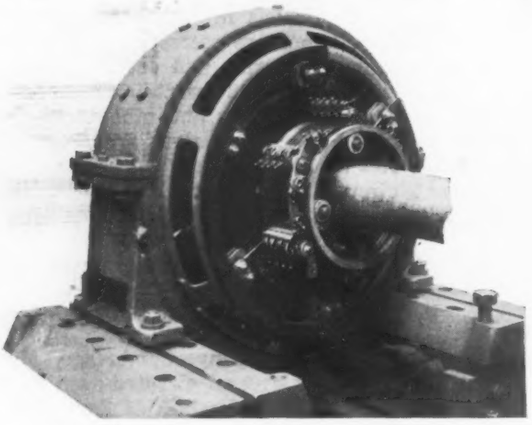


FIG. 1—250-VOLT THREE-WIRE ENGINE-TYPE GENERATOR

in standard ratings from 25 kw to 400 kw. Similar two-wire machines are also available. These units have either shunt or compound field windings and the armatures are designed to deliver the rated output at any pressure from 115 volts to 125 volts and from 230 volts to 250 volts. Larger sizes wound for 250-volt operation are also manufactured.

A new feature of these generators is the development

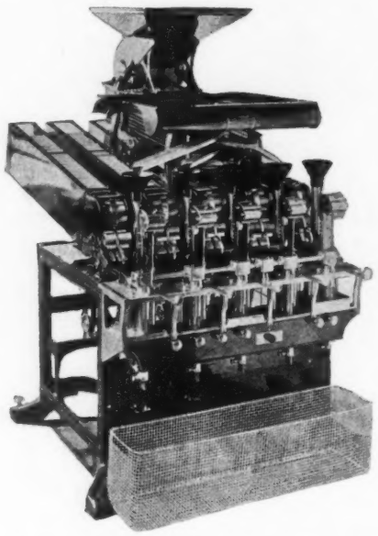
FIG. 2—ARMATURE WITH REVOLVING COMPENSATOR

of the three-wire machines with a special type of revolving compensator or auto-transformer, one point of which is connected to a single collector ring for obtaining the neutral for three-wire operation. This revolving compensator consists of a circular magnetic core on which are mounted suitable exciting coils, the core with its coils being assembled on a cast bracket bolted directly to the back end of the armature spider. The compensator fits under the overhanging end windings of the armature. The neutral brushes bearing on the collector ring are supported by but insulated from the main brush-holder studs.

In the three-wire generator the series and commutating fields are equally divided between the two sides (positive and negative) of the armature, insuring exact compounding for all load conditions, whether balanced or unbalanced. The three-wire machines are designed to carry an unbalanced current of 25 per cent of the rated full-load current in the neutral.

Coin-Handling Machine

The machine shown in the illustration is designed to sort out into their respective denominations the coins placed in its hopper, count them in dollars and cents and wrap them up into standard packages or sack them as desired, at the same time separating out mutilated coins and throwing them into a special receptacle.



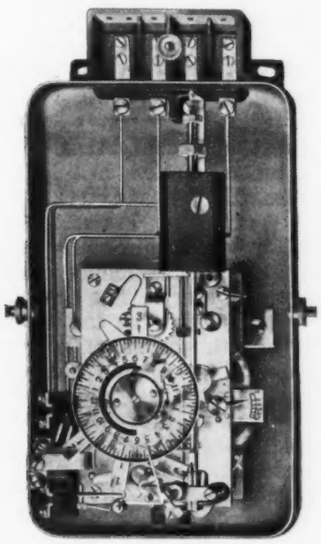
MACHINE FOR SORTING AND COUNTING COINS

The device is adapted for use by companies which have to handle small coins in large quantities, among these being street-railway companies, gas and electricity supply companies, department stores, tax-receiving offices, banks, moving-picture theaters, etc. Use of the machine will, it is declared, cut down materially the time required to handle coins, eliminate errors in counting and prevent pilfering. The machine is made by the Sattley Coin-Handling Machine Company, Detroit, Mich., and is operated by a small Westinghouse motor.

Automatic Switches for Staircase Lighting

Messrs. Landis & Gyr, of Zug, Switzerland, who have a sales office at 168 North LaSalle Street, Chicago, manufacture the form of automatic switch shown herewith, which is extensively employed abroad for controlling the lighting of staircases in apartment houses, public buildings, etc. The clock mechanism switches the lamps on and off at any predetermined hours, at the same time making it possible to obtain light at other times for a limited number of minutes by pressing

push-buttons which can be placed at the main entrance to the building or on one or more landings. The push-buttons actuate auxiliary circuits and light the lamps for two to six minutes, depending upon the setting of the dial mechanism. In this way the lighting of halls, stairways, etc., is turned on during certain hours, and is also available for intervals of a few minutes at all

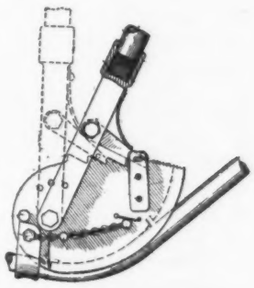


SWITCH FOR AUTOMATIC STAIRCASE LIGHTING

other times when the lamps are regularly extinguished. The clock mechanism is of the hand-wound type and runs for five weeks on one winding. These switches can be furnished for direct-current, single-phase and polyphase circuits.

Pipe-Bending Tool for Conduit Work

Messrs. O. A. Malo and F. H. Melat, 7514 Dante Avenue, Chicago, have recently invented an improved pipe-bending tool to be used where neat bends of equal radius are required. The tool consists of a cast-steel forming shoe to which is attached a ratchet and pawl and a long iron-pipe handle. It is claimed that neat bends of practically identical radius can be made with this tool at a speed impossible with other devices. Shifting the pin attached to the small chain shown in the

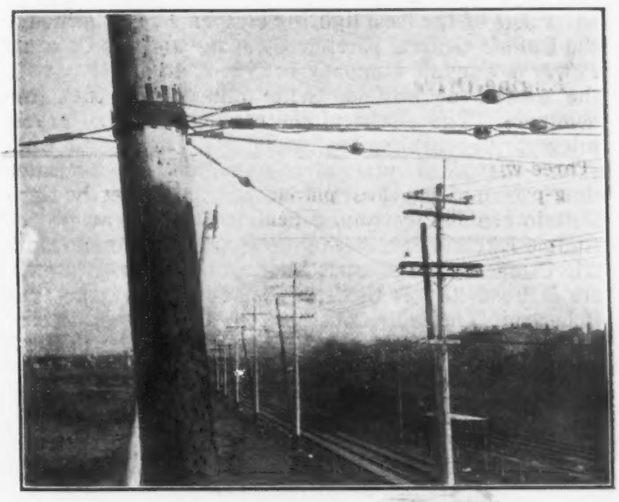


PORTABLE PIPE-BENDING TOOL

illustrations allows the manipulator to reverse operations and straighten a bent pipe to any desired degree. Removable shoes are supplied with the tools to make bends of different radii. The method of setting screw threads for the handle is said to be a feature devised to prevent the handle breaking on account of reduced section in the threads.

Boltless Guy Clamps

In the accompanying illustration is shown an installation of boltless guy clamps used on the construction work of the Electric Company of Missouri. These "Giant" clamps, as they are called, are designed to bear all strains that may be put on 0.25-in. and 0.3125-in.

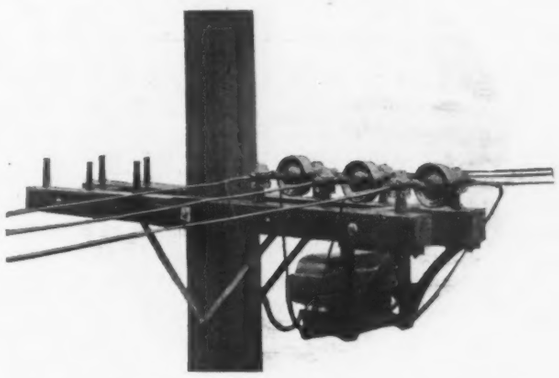


INSTALLATION OF BOLTLESS GUY CLAMPS

strands. The clamps are sherardized to prevent rusting. They are manufactured by W. N. Matthews & Brother, St. Louis, Mo.

Pole-Switch Bracket Equipment

The High-Tension Electrical Specialty Company, of Newton, Mass., has brought out a special design of brackets and strap-hanger irons, as shown in the accompanying illustration, for facilitating the hanging of pole-type switches. The brackets are attached under the double cross-arm and the switch is hung on the brackets. As the distance between the brackets varies according to the pole thickness, compensation is secured by the strap hanger on the back of the switch,



METHOD OF SUPPORTING SWITCH ON POLES

which allows the latter to be hung under all conditions of pole thickness. This method of installation also makes the operating handle on the front of the switch easily accessible to the man climbing the pole. In a similar manner the switch may be hung on a buck-arm or header when it is desired that the circuit out of the switch shall lead off at right angles to the main line.

Jobber, Dealer and Contractor

Contractors at the Buffalo Electric Show

Without doubt the success of the electric show held in Buffalo, N. Y., last week was in very large measure due to the enterprise of the electrical contractors of that city. Ordinarily electric shows are given under the patronage of the local lighting companies, but, although the Buffalo General Electric Company and the Cataract Power & Conduit Company both took an active part in the exhibit at Buffalo, their influence did not predominate. The electrical contracting was the largest interest in evidence, indicating very clearly to what extent the broad spirit of co-operation has permeated that branch of the electrical industry. Among the large Buffalo contractors taking part in the show were the Buffalo Electric Contracting Company, the Buffalo Electric Company, the Electric Shop, Inc., McCarthy Brothers & Ford, the J. C. Sterns Electrical Company, the Robertson Electric Construction Company and the Sterns Electric Equipment Company. The exhibits

BUFFALO ELECTRIC SHOW

made by these firms were in keeping with the diversified character of their business. Various accessories used in wiring houses and industrial plants and the many appliances which contribute so much to the comfort of the home and to the increased efficiency and convenience of manufacture were on exhibit.

Results of Forty-Dollar Group Appliance Campaign in Toledo

In a group appliance campaign, conducted for one month only, the Toledo Railways & Light Company sold 350 forty-dollar groups of electrical appliances. Customers had their choice of eight groups of appliances, each containing an electric vacuum cleaner, together with such other apparatus as ordinarily sells for $50. The part-payment scheme was used, the purchaser paying $5 down and the remainder in monthly payments of $5. The feature of the campaign was, of course, the vacuum cleaner.

When it became known among the supply dealers in Toledo that the central-station company contemplated putting on a campaign of this nature several dealers protested against the step, declaring that it would ruin their business. The extent to which they were wrong, however, is shown by their own statements following the campaign. One of these dealers reported that on account of the publicity given the vacuum cleaner during this one month's campaign he was able to sell one sweeper a day for two successive months, although heretofore local sales were decidedly dull. While the campaign was in progress and since its completion practically every dealer in the city handling vacuum cleaners has admitted that the campaign not only did not hurt his business but was directly responsible for an appreciable increase in sales.

Why Contractors and Central Stations Should Co-operate

At the round-table convention of the commercial men of Ohio central stations held at Toledo last month Mr. P. L. Miles, of Cleveland, took up the cudgels for the electrical contractor. He said the continual hue and cry, that the electrical contractor is a poor business man, that he is commercially unprogressive, is today an oft-repeated story. The charge has been made time and time again that the contractor does not take full advantage of the offers of co-operation received from both manufacturers and central stations, that good business opportunities are overlooked, that no efforts tending toward proper and efficient business-building and sales methods are employed.

While these articles calling attention to the contractor's business methods, or rather lack of business methods are legion, yet suggestions having a commercial and practical value are seemingly few. The criticisms are made, yet remedial methods directing the electrical contractor along proper lines of commercial development have been sadly missing.

Channel of Development

If the contractor is guilty of the charge of not giving sufficient attention to the business-building and sales end of his business, he does not stand alone by any means. It is only a matter of a few years back when the central-station man was in the same position. To-day garage men are resting under the same indictment; and so it has been with most businesses in their infancy.

The development in the contracting business, as in the central-station business, has been largely along mechanical and engineering lines, and the development in this direction has been nothing short of phenomenal. Not so many years ago the sales department or new-business department of the central station was unheard of. But to-day it is one of the most important departments in the up-to-date and progressive public utilities.

The channel of development for the electrical contractor should be largely along this same line, that of business building and sales effort—following in the lines of central-station practice. Proper appreciation should be given to this work as a means of increasing business—as a means of earning more and greater profits. Advantage should be taken of the many offers of co-operation from the manufacturer, the jobber and the central station, and mediums of known value in increasing sales should be adopted.

The various phases of business building, as well as the co-operation which may be expected from the manufacturer and the central station, whereby the contractor can materially increase his business, were taken up and an attempt was made to show how the various services of the manufacturer may be utilized to the greatest extent and how cordial relations may be established between the contractor and the central station to their mutual advantage.

This is a large and important subject, and in order to give it a thorough and detailed treatment, the speaker dwelt upon only one phase of the contractor's business.

namely, that of the wiring of residences, and with special reference to the wiring of houses built but not wired for electricity.

Wiring of Residences

The magnitude of this field should be borne in mind. In the smallest of towns there are hundreds of houses which are not wired, while the occupants are well able to afford the expense of doing this work. In the entire country it is estimated that only about 8 per cent of all houses are equipped for electricity. These figures, of course, take in both urban and suburban homes, yet the percentage in cities alone is as low as 12 per cent or 15 per cent. In Toledo, for instance, there are approximately 55,000 homes, and of this number there are only 9000 electric-light users, or about 16 per cent. Within the last few months over 10,000 prospective customers in Toledo alone have received a series of letters from the central station relative to house-wiring. It will be seen from this that the field is practically unlimited.

The question to be decided is what is the proper method to go about wiring these homes.

Granting for a moment that the electric contractors are lax in their selling methods, granting that they have no men that are properly equipped as salesmen to go out and close contracts for wiring, the central stations as a rule are willing to bear this portion of the selling expense. They have a well-equipped and efficient sales force—men whose entire business is that of selling. They can go out among the residences in the town and bring in orders for wiring—orders which are, as a rule, turned over to the contractors for completion.

These central-station salesmen have all of the talking points at their fingers' tips and can tell why electricity should be installed, tell of its economy, convenience and safety, can give an approximate idea of the monthly bills, can quote terms of payment. But can these salesmen quote prices for doing work—give estimates of the wiring cost?

No contracts for house wiring can be closed until this point of "How much will it cost?" is settled. The home owner will not give an order to do the work unless he knows how much it will cost. Many times this is where the central-station salesman runs up against a stone wall. He has to get in touch with one of the local contractors, come back the next day with the contractor and go over the job, and the day following submit the proposition to the home owner. This is a poor selling arrangement. The estimate should be given at the time the "prospect" is interested, given while he wants it and while he is in the mood to sign the contract. But how can the central-station salesman do this? He is not a wireman himself and could hardly be expected to estimate a job in such a manner that his estimate would be acceptable to the contractors. Estimating is part and parcel of the sales work. It would be a poor lamp salesman who could not tell a prospective purchaser what a certain lamp would cost.

A little co-operation between the central stations and the contractors will soon solve this problem. The contractor is weak in not having a sales force. But this is supplied by the central station. The central station is weak in not having a definite proposition to offer to the "prospect," an estimate of the cost of doing the work of wiring. This must be supplied by the contractor. Here is an admittedly weak point on the part of the contractor and also one on the part of the central station. But a little of the "get-together" spirit on the part of both will soon show a way in which all objections may be overcome. Every job offers a profit to the contractor, while to the central station it gives a revenue for energy. Why should not they co-operate when their interests are mutual?

Flat Rate per Outlet

There are several ways in which the difficulty may be overcome. Probably the method which is most commonly in use is the adoption by the contractors of an easy basis of estimating the cost of house wiring. Such methods are the flat-rate-per-outlet basis, the flat rate per house of a certain number of rooms, and the flat rate per a certain number of outlets.

"Yes, indeed," the contractor is heard to say; "this is very fine—fine for the central station. But no method of estimating along these lines can be devised which will eliminate the likelihood of our losing money. Every job needs an individual estimate to insure us a fair margin of profit."

This admits of no argument. Central-station men readily acknowledge as much. At the same time the central-station man has no disposition to see the contractor lose money on any job. The central-station man of to-day is given to the policy of "live and let live." He wants the contractor to make a profit on every job, knowing that as the profits increase the contractor will become a better business man and better equipped to take care of the electrical needs in the community.

However, the profit on the individual job should not be the important point to consider. Profit at the end of the month should be the deciding factor as to the feasibility of such a program. It is true that a flat-rate basis of estimating may force the contractor to do the work at actual cost, or even below cost, on some particular job of hard construction; yet on another of easy construction the margin of profit will be decidedly more than might be considered a fair profit, entirely offsetting the loss on the previous estimate. By averaging the profit on these two jobs it will be found that a good margin exists for each outlet. This basis of estimating should be so arranged that any danger of loss is guarded against. It should be so arranged that at the end of the month the books will show a fair margin of profit on the total of all wiring contracts.

To accomplish this means very little on the part of the contractor. It only means that all the reliable contractors in a certain locality get together, talk matters over and submit an outline of a proposition to the central station whereby the lighting company can allow its salesmen to do the estimating. Such co-operation will pay—pay both the contractor and the central station. For instance, if at the present time there are only 100 houses wired per month in a town, and through this method of estimating the selling ability of the salesmen is increased only 50 per cent, it means that there will be 150 wiring jobs for the contractors to complete. More than this, such a plan, of a certain stipulated amount per outlet, agreed to by all the electrical contractors in a community, means that they will no longer be harassed by vicious competition and destructive price cutting. The price is the same for one and all. So not only will each job show a fair margin of profit to the contractor, but there will be 150 jobs on which this profit will be made instead of only 100.

A little lunch where the contractors may get together, discuss the plans and agree upon some method of estimating will soon pave the way to more wiring contracts and a greater profit on each contract. It probably rests with the lighting company to take the initiative in getting the contractors together, to agree upon some equitable method of estimating the cost of wiring.

This is not a new scheme by any means. It is in operation in Toledo, Dayton, Cleveland and Columbus, and it is also in operation among the larger central stations of New York, Brooklyn, Boston and Baltimore. It is not an untried theory. It is an actual practice and is proving its value to the contractors in these different localities, as they most readily agree.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

American Engineers Retained on Proposed Canadian Electrification.—Westinghouse, Church, Kerr & Company, of Montreal and New York, have been retained by the Canadian Pacific Railway as engineers to investigate the matter of the proposed electrification of the new double-track 5½-mile Selkirk Tunnel in British Columbia. The investigations will cover in general the type of system to be installed, the relative economies of steam and water-power and the effect of the electrification upon operating conditions.

Large Generating Units for Scranton and Canton.—The American Gas & Electric Company, of which George N. Tidd is senior vice-president and general manager, has closed contract with the General Electric Company for large turbo-generators for its properties at Scranton, Pa., and Canton, Ohio. The machines will be duplicates, each consisting of a steam turbine and a 10,000-kva, sixty-cycle, three-phase generator. One will be installed in the plant of the Canton Electric Company, where there is enough boiler equipment to serve steam demands of the new unit. The other will be placed in the plant of the Scranton Electric Company, where new boilers, already ordered from the Babcock & Wilcox Company, will be needed. Sargent & Lundy, of Chicago, are the consulting engineers for these plant extensions.

Recent Westinghouse Achievements Reviewed.—At a recent dinner of the Westinghouse companies in Pittsburgh, Pa., Vice-president C. A. Terry of the Westinghouse Electric & Manufacturing Company reviewed briefly some of the more notable and interesting of that company's recent achievements. He first mentioned the 3000-kw vertical, synchronous-booster, commutating-pole rotary converter developed in 1912, of which two were supplied to the New York Edison Company, and which was the largest device of that character ever built. Among the other features mentioned were the equipment of a 150,000-volt transmission line for the Pacific Light & Power Company, with transformers tested to 375,000 volts, the supplying of a 6000-hp motor (the largest motor ever built) to the Minnesota Steel Company at Minneapolis, and the application of a split-phase locomotive to the electrification of the Norfolk & Western Railroad in Virginia. Mr. Terry said, in closing, that during 1913 his company sold over 100,000 fan motors and about 380,000 electric meters.

Bell Telephone Statistics for 1913.—The financial statement for the associated companies in the Bell Telephone System, covering the year ended Dec. 31, 1913, shows—with all duplications between companies eliminated—gross earnings of $215,572,822, expenses of $156,883,299, interest payments of $16,652,624, dividends of $30,301,705 paid, and surplus earnings of $11,735,194, realized. The total surplus and reserves of the combined companies on the above date were $174,497,695 and the total assets reached a figure of $980,004,095. The figures on the American Telephone & Telegraph Company, the largest of the Bell companies, show for the year ended Dec. 31, 1913, gross earnings of $45,909,991, expenses of $5,333,245, interest payments of $7,656,655, dividend payments of $27,454,037, and a balance carried to reserves and surplus of $5,466,053. The total surplus of the American company on the above date was $100,492,160, and its total liabilities amounted to $655,956,307. Some interesting statistics on the Bell system were included in its annual report. On Dec. 31, 1913, it had 323,051 miles of pole line in service and 16,111,011 miles of wire. A total of 8,133,017 stations were connected by this system on that date, and the combined exchange and toll connections made daily averaged 27,237,161. The combined companies employed 156,928 persons.

Oil Engines and Centrifugal Pumps Find Extensive Use in Europe.—J. E. Noeggerath, of 59 Wall Street, New York, returned recently from a business trip of several months to Switzerland, Germany and Belgium, and in a short interview this week he gave some interesting information concerning the advances made abroad in the applications of the Diesel engine and the centrifugal pump, two pieces of apparatus in which Mr. Noeggerath was specially interested. The former, he said, is enjoying an increasing use for generator drive and other purposes in spite of the fact that oil fuel is not as plentiful there as in certain sections of this country. He stated that there, as here, certain limitations to the size of the unit cylinder in this type of engine are recognized, but he thinks that improvements in design may overcome some of the difficulties. He stated that in the design and application of centrifugal pumps the foreign engineering practice is far ahead of our own. Mr. Noeggerath spoke of the proposed St. Gothard Tunnel electrification which is now under way and expressed the opinion that matters of government policy have played a large part in the determination to use single-phase construction. He said that greater activity is being shown in Europe than in the United States in the development of turbine-driven direct-current generating units.

Taxes on Foreign Commercial Representatives in Bolivia and Chili.—Taxes are levied on foreign business agents in all Bolivian cities. The rates vary from $80 to $400 and the collection system is very irregular. The licenses are generally good from the date of issue to the end of the calendar year. No legal provision is made for the free importation of samples; but this is customary on furnishing of security for the final re-exportation within a certain limit of time, or the payment of the duty. Foreign agents in Chili are not required to take out licenses. Samples may be imported duty free for a maximum period of six months, on furnishing of security for the final payment, if not re-exported within that time. Samples shipped from one Chilian port to another have to go through the entire customs formality at the second port, just as if they came directly from a foreign port. A departing traveling agent has to submit a list of the articles on which duty-free entry was allowed, along with a list of the articles actually being re-exported, and duty is charged on any items missing from the second list. The traveler has also to furnish proof of the actual entry of the samples into a foreign port, this proof taking the form of a foreign customs document, authenticated by the Chilian consul at that port or the consul of a friendly nation. The time allowed for this is 90 days for ports in South America and 180 days for other ports of the world.

Large Storage Battery Installed by Indiana Utility.—The Electric Storage Battery Company, of Philadelphia, Pa., has recently supplied to the Indianapolis (Ind.) Light & Heat Company a battery consisting of 156 "Exide" type H-61 cells, with a capacity of 4500 amp for one hour or 9300 amp for twenty minutes. It is installed with seventy-eight cells on each side of the neutral of a three-wire system, and of this number twenty-two are end cells. There are four remote-control, motor-driven, end-cell switches, two on each side of the system, each having a continuous capacity of 5000 amp, with an overload capacity sufficient to carry any output that the battery can give. The switchboard equipment for the control of the battery consists of eight panels. On this board, in addition to the knife switches for connecting the end-cell switches to the bus and the usual indicating instruments, there is installed for each end-cell switch one of the Electric Storage Battery Company's recently developed indicating control switches, a description of which appeared in the Feb. 28 issue of the *Electrical*

World. This battery installation is at Substation No. 6, which is equipped with a 1000-kw motor-generator set, driven by a three-phase induction motor and delivering direct current to the 240-volt bus. The neutral point of the battery is connected to the neutral of the system, but no other neutral is provided at this substation, the motor-generator set being connected directly across the outside wires at 240 volts. For charging the battery there is installed a three-unit booster set, consisting of a synchronous motor driving two direct-current generators.

Foreign Activities in the Electrical Industry.—The electrical manufacturing enterprises in Japan are becoming continually more prominent and are rivaling the operating companies in activity. The Shibaura Engineering Works, at Tokyo, in which the General Electric Company has a large interest, makes motor, generator, transformer and other power apparatus in sizes up to 4000 kw, but a large part of the big electrical apparatus used is still imported. The General Electric Company is also heavily interested in the lamp-manufacturing enterprises of Japan, including the Tokyo Electric Company, Ltd., which has extensive factories at Kawasaki and furnishes a large portion of the lamps used in Japan. In Silesia, Germany, there is some sale of electrical heating and cooking appliances, and these are generally operated at 220 volts. At present the German manufacturers have control of the market, but they have instituted branch retail houses in competition with the local dealers, and the latter are inclined to favor American-made appliances where they can compete with the German articles in price. Very small stocks of this kind of apparatus are carried, and in many cases appliances are sold from catalogs only, so the American manufacturer wishing to enter the field would have to approach the wholesale jobber as a possible distributing agent.

Another Method for Pushing Production.—In the Feb. 21 issue of the *Electrical World* a note was given on the system used by one of the leading manufacturers of the country for keeping track of orders in their progress through its shops. A letter recently received from the Terry Turbine Company, of Hartford, Conn., on the same general topic, contains additional matter of interest and may draw out other ideas by which the industry as a whole will profit. This company writes, in part, as follows: "We are quite pleased with and rather proud of our system for following orders and keeping production up to a maximum. This consists primarily of a large bulletin board, divided into the days of the year by means of vertical lines, and ruled horizontally to form small squares. When an order is received here at the works the same is entered on one of the horizontal lines of this board, and a certain colored tack immediately placed in the square showing the date on which shipment must be made. As the order progresses through the shops, variously colored tacks signifying certain operations, such as approval of contract, ordering of outside material, completion of erection and completion of testing, are placed on this board under the days on which these respective operations took place or were completed. In this way it is possible to tell at a glance just how any particular order stands, and if the tacks do not appear at regular intervals in connection with any order, or as soon as previous experience would indicate was the proper time, investigation is immediately made in order to ascertain the reason for the delay."

Co-operation of School and Factory in Technical and Commercial Training.—The Western Electric Company takes into service at its Hawthorne Works boys who have had rudimentary technical and manual-training instruction in the Phillips, Lane and Crane technical high schools of the Chicago public-school system. Mr. J. W. Dietz, manager of the educational department of the company, is quoted as saying that the company finds that the young men it obtains from the technical high schools have been helped by their work in those schools. The time spent in the technical high schools seems to result in putting students in a position to advance more rapidly when they begin practical work in the manufacturing establishment. The company also co-operates with the Austin High School in employing students from the commercial classes of that school for alternate weeks; that is, the students work for the company one week and then go back to school the next week, and so on. The Western Electric Company has a school department which is designed to supplement public-school work by giving instruction in specialized lines. For the college men who come to the establishment well grounded in the theories underlying technical work three courses are provided. One of these is in the commercial end of the business, the second in the manufacturing end and the third in engineering work. Some boys receive instruction to help them to become skilled mechanics or toolmakers. There is also instruction in drafting for high-school boys who enter the drawing department. For office people there is a class in stenography and the use of the comptometer. The Hawthorne Men's Club conducts classes from 6 to 7:30 p. m. in elementary electricity and magnetism, in shop mathematics, telephone practice and shop practice. All of this educational work, which is under the general supervision of Mr. Dietz, is intended, not to make up for deficiencies in public-school or college preparation, but rather to give the more specialized information which is required in the activities of the Western Electric Company.

Electrical and Allied Imports in the Third Quarter of 1913.—In the Dec. 27 issue of the *Electrical World* some statistics were given on the electrical import business for the year July 1, 1912, to June 30, 1913. The following table, compiled from a recent bulletin of the Department of Commerce at Washington, D. C., shows the figures on the same items for the third quarter of 1913 from July 1 to Oct. 3, the rates in the tariff law of 1909 applying. Comparison of the two tables gives an idea of the slump in these imports during the latter period. The total duty collected on these particular items from July 1 to Oct. 3, 1913, was only 17.8 per cent of the collection during the year from July 1, 1912, to June 30, 1913.

ELECTRICAL AND ALLIED IMPORTS JULY 1-OCT. 3, 1913.

Items	Valuation	Duty
Aluminum:		
Crude form, scrap and alloys	$527,785	$218,852
Plates, sheets, bars and rods	88,008	35,347
Asbestos:		
Unmanufactured	528,397	.....
Woven	22,223	8,889
Carbons:		
Electric-light lampblack or retort carbon	61,808	22,517
Electrodes and brushes	34,859	10,457
Coal:		
Bituminous and shale	661,876	107,161
Culm and slack	134,190	10,430
Copper:		
Pigs, ingots and bars	12,333,126	.....
China and porcelain wares not decorated	287,439	158,091
Electric lamps:		
Arc	7,802	3,510
Metal filament	73,409	33,034
Carbon filament	1,510	679
India rubber and gutta percha:		
Crude	18,096,773	.....
Manufactured	195,035	68,262
Hard rubber	64,277	22,497
Iron or steel sheets	5,749	1,261
Mica:		
Unmanufactured	228,130	73,992
Ground	384	77
Manufactured	22,927	5,885
Models of inventions	6,046	.....
Nickel:		
Alloys, ingots and pigs	16,669	2,215

NEW YORK METAL MARKET PRICES

	Mar. 10 Bid	Mar. 10 Asked	Mar. 17 Bid	Mar. 17 Asked
Copper:				
Standard spot*	13.37½	14.00	13.60	14.25
	Selling Prices		Selling Prices	
	£ s. d.		£ s. d.	
London, standard, spot*	63 18 9		63 16 3	
Prime Lake	.....	.....	14.50	to 14.75
Electrolytic	14.25	to 14.35	14.12½	to 14.25
Casting	14.10	to 14.20	14.00	to 14.12½
Copper wire base	15.50	.....	15.50	.....
Lead		4.00		4.00
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter		7.25		7.00
Spelter, spot	5.35	.....	5.35	.....
Tin, spot	37.62½	to 37.87½	38.10	to 38.50
Aluminum:				
Prompt delivery	18.37½	to 18.62½	18.00	to 18.25
Future	18.37½	to 18.62½	18.00	to 18.25

***OLD METALS**

Heavy copper and wire	13.62½	13.62½
Brass, heavy	8.62½	8.62½
Brass, light	7.62½	7.62½
Lead, heavy	4.00	4.00
Zinc, scrap	4.25	4.25

***COPPER EXPORTS**

Total tons to March 17 24,854

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Receivers for Central Union Telephone Company.—The receivers for the Central Union Telephone Company have been appointed by the court. They are David R. Forgan, Edgar S. Bloom and Frank F. Fowle, for the properties in the States of Illinois and Ohio, and the same gentlemen, with the addition of John A. Moriarty, for the state of Indiana. The receivers have established an office at Chicago.

Northern States Company Reports Increase in Earnings.—The Northern States Power Company, one of the Byllesby properties, reports gross earnings for itself and its subsidiaries for the year ended Jan. 31, 1914, as $3,916,065. The net earnings are given as $1,992,091, which may be compared with $1,789,728 for the preceding year. From the net earnings interest charges amounting to $1,223,008 were paid, as well as preferred stock dividends of $574,430.

Western Union Telegraph on 4 Per Cent Basis.—At the meeting of the board of directors of the Western Union Telegraph Company on March 11 a quarterly dividend of 1 per cent was declared on the outstanding $99,786,700 capital stock of that company, raising the rate from 3 to 4 per cent per annum. Announcement was made of the resignations from the board of directors of J. P. Morgan, Henry Walters and W. H. Moore, and of the election of E. G. Merrill to the latter vacancy. About two weeks ago a profit-sharing plan was inaugurated by the company whereby its employees are allowed to buy stock of the company, at approximately market price, in even shares to the extent of about half of their annual salaries. In order to prevent this stock being used in a speculative manner, none will be delivered until March 1, 1915.

January Earnings of Electrical Utilities.—Reports received from sixty-seven electric utility companies indicate substantial gains in earnings for January, 1914, as compared with January, 1913. These returns are not sufficiently comprehensive to afford any reliable conclusions regarding the condition of the industry as a whole, but the properties, which include electric railway plants and central light and power stations scattered over various sections of the Union, show that a gross income of $2,516,505 for January, 1913, has increased to $2,821,213 for January, 1914—an expansion of a trifle over 12 per cent. The earnings of all the railway and lighting plants in the country were probably in the neighborhood of $90,000,000 for the month. Of the sixty-seven companies, whose reports have been analyzed just as received, without any attempt at a systematic census, half a dozen show a decrease in gross earnings ranging from a fraction up to 4 and 5 per cent, and apart from this it is probable that the present rate of increase which the electricity supply stations of the country are experiencing is appreciably less than was the case eighteen months ago, when 20 or 25 per cent was, as it had been for years, the annual expansion constant. The probable reason is not an approach to saturation. Times just now are not booming; but a slow betterment is apparent and probably companies showing only 5 and 10 per cent increase now will be returning 15 and 20 per cent increase by the end of the year, when business generally will possibly have resumed a vigorously healthy condition.

Organization Changes in Two Barstow Holding Companies.—The following officers have been elected to serve the Eastern Power & Light Company during the present year: President, W. S. Barstow; vice-presidents, J. B. Taylor and F. V. Henshaw; secretary and treasurer, A. P. Taliaferro. The General Gas & Electric Company has elected for the same period W. S. Barstow as president, J. B. Taylor as vice-president, and O. C. Swenson as secretary and treasurer. The first-named company controls the following operating companies: Colonial Power & Light Company, Claremont Railway & Lighting Company, Claremont Power Company, Clarendon Power Company, City Electric Lighting Company of Vincennes, Vincennes Electric Company, West Virginia Traction & Electric Company, Reading Transit & Light Company. The second mentioned controls the following operating companies: Western Vermont Power & Light Company, Rutland Railway, Light & Power Company, Pittsford Power Company, Northwestern Ohio Railway & Power Company, Sandusky Gas & Electric Company, Port Clinton Electric Light & Power Company. T. R. Robinson has accepted the position of operating engineer with W. S. Barstow & Company, Inc., and will have supervision over the operations of the subsidary companies of the General Gas & Electric Company. William Buchsbaum has tendered his resignation as treasurer of the Reading Transit & Light Company and the Metropolitan Electric Company of Reading, Pa., to take charge of the auditing department of W. S. Barstow & Company, Inc. E. D. Gault has been elected treasurer of the Reading Transit & Light Company and the Metropolitan Electric Company of Reading, Pa., vice William Buchsbaum, resigned.

Annual Report of the Washington Water Power Company.—For the year ended Dec. 31, 1913, the gross receipts of the Washington Water Power Company amounted to $2,909,147, and the operating expenses came to $1,291,673. The payment of dividends, interest and various fixed charges required a reduction of the surplus, and this item amounted to $1,119,105 on the above date. The total assets of the company amount to $23,405,810. The maximum load on the generating stations of the company during 1913 was 40,521 hp and the total output for the same period was 157,061,662 kw-hr. The outstanding stock of the company amounts to $14,081,900, its outstanding bonds to $5,524,000, and its notes and other debts to $2,333,500. The principal expenditures for extensions and improvements during 1913 totaled $2,012,845. The company acquired on July 1, 1913, the Idaho-Washington Light & Power Company, which operates in the towns of Moscow, Genesee, Troy and St. Maries, Idaho, and in Tekoa, Garfield, Colton, Uniontown, Palouse, Farmington, Oakesdale and Pullman, Wash. The property of the Big Bend Light & Power Company, covering the local distributing systems in the towns of Reardan, Davenport, Sprague, Harrington, Ritzville and Lind, Wash., was acquired Jan. 1, 1914. The wholesale power supply for these towns was heretofore purchased from the Washington Water Power Company. The work contemplated in 1914 for the electric light and power system consists principally of continuing the construction of the Long Lake power station and extending the distribution system in Spokane and in the surrounding territory, especially in the country districts. Much work has been done during the past year to extend electric light and power service to farmers near the country lines of the company, and this last field is considered to be a very promising one for future work.

American Water Works & Guarantee Reorganization Plans.—A statement has finally been given out concerning the plans for rehabilitating the finances of the properties controlled by the American Water Works & Guarantee Company, which has been in the hands of receivers for about eight months past. The name of the new company which will take over these properties is the American Water Works & Electric Company, and its authorized capitalization consists of $10,000,000 of 7 per cent cumulative first preferred, $10,000,000 of 6 per cent participating preferred and $10,000,000 of common stock, and $20,000,000 of collateral trust 5 per cent twenty-year bonds. Of this it is proposed to issue at the present time $5,000,000 of first preferred, $10,000,000 of participating preferred and $7,000,000 of common stock, and $6,250,000 of the bonds, of which not exceeding $3,700,000 are to be available as collateral. Holders of preferred stock of the old company will be entitled, under the reorganization plan, on payment of $35 per share, to $40 par value of first preferred stock of the new company and $100 par value of participating preferred stock of the same. An alternative for preferred stockholders of the old concern is the receipt of $50 par value of participating preferred stock on the payment of $5 per share of the old stock held. Common-stock holders of the old company will receive on payment of $10 per share $10 per value of first preferred and $70 par value of common stock of the new concern. The alternative for common-stock holders of the old corporation is to receive $10 par value of new common stock on payment of 50 cents per share of old stock held. On March 16 Judge Orr in the United States District Court at Pittsburgh, Pa., granted the application of the receivers of the American Water Works & Guarantee Company for permission to sell the property of that corporation. The sale will be conducted by H. B. Bruno on April 15. This court decision will mark the end of the receivership.

Business Notes

The Driver Harris Wire Company, of Harrison, N. J., has recently advanced Arlington Bensel from the position of sales manager to that of vice-president and sales manager.

The Connecticut Telephone & Electric Company, of Meriden, Conn., maker of ignition apparatus, has recently appointed C. E. Stahl, of Chicago, Ill., to the position of sales manager.

Meikleham & Dinsmore, bankers and public utility managers, of 25 Broad Street, New York City, have recently added to their sales force in eastern Pennsylvania S. M. Conger, People's Bank Building, Scranton, Pa., and Edward Stair, York, Pa.

The Steel City Electric Company, of Pittsburgh, Pa., has announced the appointment of W. L. Commiskey as its exclusive sales representative in the States of Missouri, Arkansas, Kansas and Oklahoma, with offices at 1117 Olive Street, St. Louis, Mo.

The C. & C. Electric & Manufacturing Company, of Garwood, N. J., announces that its Cincinnati representative, F. A. Saylor, whose headquarters are at Sixth and Vine Streets in that city, will have temporary charge of the Indianapolis territory of the company.

The United Electric Lamp Company, of Bush Terminal, Brooklyn, N. Y., has secured the services of J. H. W. Rees as its general manager. Mr. Rees is well known in the commercial and industrial field, was formerly executive advertising manager of the national Progressive party, and until recently held the position of advertising manager of Deuth & Company, of New York, incandescent lamp importers. The United company claims to be operated along independent lines, handling a wire-drawn tungsten lamp of domestic manufacture.

The Esterline Company, of Indianapolis, Ind., has appointed the following men to agency managerships in the new branch offices mentioned: F. C. Morton, Walker Bank Building, Salt Lake City, Utah; G. W. Pieksen, Railway Exchange Building, St. Louis, Mo.; J. S. Black, 908 Hennen Building, New Orleans, La.; G. L. Priest, 229 Sherlock Building, Portland, Ore. The W. W. Geisse Company, McKnight Building, Minneapolis, Minn., and the General Supplies Company, Ltd., of 122 Eleventh Avenue West, Calgary, Alta., have also received agency appointments. The above offices are to be completely equipped for handling the company's business in graphic meters in their several localities.

New Industrial Companies

E. C. Sykes & Company, of Rochester, N. Y., have been incorporated with a capital stock of $25,000 to do a general contracting business and electrical work. The incorporators are E. C. Sykes, E. D. Wilcox and S. P. Sykes, of Rochester, N. Y.

The Main Electric Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $100,000 and proposes to manufacture and sell electrical machinery. The incorporators are H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del.

The Pennsylvania Indicator Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000. The company proposes to manufacture stop or designating indicators for use in electric, steam or horse cars. The incorporators are E. O. Babcock, of Niagara Falls, N. Y.; G. C. Jones and W. A. Norris, of Erie, Pa.

The Electrical Steam Radiator Company, of Portland, Maine, has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $200,000 and proposes to manufacture and deal in electrical appliances, machinery and electrically heated or lighted devices. The officers are: J. D. Ross, president, and C. T. Sweet, treasurer, both of Portland, Maine.

Trade Publications

Grounding Device.—Bulletin R, published recently by the Lord Manufacturing Company, Bush Terminal, Brooklyn, N. Y., refers to "Hydroground," a device for grounding electrical circuits. Its structural features are illustrated and described.

Oil Engines.—The De La Vergne Machine Company, New York City, has issued a four-page folder on its types "HA" and "FH" oil engines, the first mentioned varying in size from 10 bhp to 100 bhp, and the other type from 90 bhp to 360 bhp.

Wiring Specialties.—M. B. Austin & Company, Chicago, Ill., have just issued replacement sheets 49, 50 and 56 for their perpetual catalog of wiring specialties. The items covered in the new sheets are conduit bushings, lock nuts, nipples and the Anthony adjustable conduit hickey.

Household Devices.—Bearing the simple title "Electrics," a twenty-four-page catalog has been issued by Manning, Bowman & Company, showing their line of electric household devices. Some artistic designs in coffee percolators, chafing dishes, tea urns, egg boilers and other useful household devices are illustrated and briefly described.

Vacuum Cleaner.—The "Dunmore" vacuum cleaner is the theme of a recent booklet issued by the Manhattan Electrical Supply Company, New York City. This cleaner is made by the Wisconsin Electrical Company and is of comparatively simple construction, with a double fan and a two-piece aluminum case. It has no revolving brushes.

Electric-Vehicle Equipment.—Westinghouse Electric Vehicle Equipment, Section 3223, gives a detailed illustrated description of the construction of the electric motor and its application. Curves are given, showing the performance of 60-volt and 80-volt motors. An illustrated article describes the equipment for charging electric-vehicle batteries.

Rectifier.—Folder 4237, issued by the Westinghouse Electric & Manufacturing Company, is entitled "The Way to Charge Three Cells." It describes the Westinghouse mechanical vibrating rectifier for charging small storage batteries used for ignition and lighting sets on automobiles. This device changes the alternating to direct current by means of the vibrating mechanism.

Instruments.—Bulletin 104 of the Wagner Electric Manufacturing Company, St. Louis, Mo., on portable instruments, admirably carries out its title, "A Manual of Electrical Testing." The forty-eight pages of thoroughly practical reading matter and the illustrations and well-planned diagrams showing methods of connection add another excellent bulletin to the Wagner Company's trade literature.

Steam Boilers.—The Hawkes Boiler Company, Chicago, Ill., has devised a novel method of illustrating the action in its fire-tube boilers, description of which is given in a recently issued pamphlet on that company's product. The device, which is called its "silent salesman," consists of a complete working model in glass and metal, which is capable of developing 1 hp and shows all the processes in the generating of steam in a boiler of that type. This novel working model is sent for inspection by such prospective customers as appear sufficiently interested to make it worth while. The catalog referred to above contains much of interest concerning the various types of boiler apparatus produced by this company, together with numerous illustrations.

High-Voltage Detector and Recording Synchroscope.—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, manufacturers of high-voltage specialties, have recently issued bulletins Nos. 2 and 3. The first relates to the Schweitzer high-voltage detector, which is said to be a reliable device for detecting high voltages and for "phasing out." It may be placed in stations or substations or used in connection with overhead or underground cables. The Schweitzer recording synchroscope, described in Bulletin No. 3, makes a permanent record of each operation of switch-closing when paralleling. It places the blame definitely for disturbances to the system during synchronizing and gives the operator a tangible record by which he can study his work. The record is taken on a paper ribbon.

Personal Mention

Mr. George R. Scribner has tendered his resignation as superintendent of the Carthage (N. Y.) Electric Light & Power Company, effective April 1.

Mr. James S. Storey has severed his connection with the Carthage (N. Y.) Electric Light & Power Company, for which he has been local manager for about a year.

Mr. Charles A. Bergen, manager of the Mount Pleasant (Tex.) property of the Texas Public Service Company, has also assumed charge of that company's Gilmer plant.

Mr. George B. Foss, superintendent of the water and light department of Uniontown, Ala., has been appointed electrical engineer for the State in charge of the electrical development at Speigner, Ala.

Mr. Theodore Dienst has been appointed business manager of the Texas Public Service Company at Bay City, Tex., succeeding Mr. W. C. Duncan. Mr. Dienst was formerly stationed at Gilmer, Tex.

Mr. H. K. Morrison, general manager of the Brockton (Mass.) Electric Light Company, has been elected general manager of the Lynn (Mass.) Gas & Electric Company as successor to the late C. F. Pritchard.

Mr. W. C. Duncan has resigned as manager of the Texas Public Service Company, at Bay City, Tex., to undertake other work for the Albert Emanuel Company, of Dayton, Ohio, which owns and operates the Bay City property.

Mr. Dana Pierce has been designated by the New York Board of Fire Underwriters to serve as one of its representatives on the advisory board of electrical engineers for the Department of Water Supply, Gas and Electricity.

Mr. R. J. Wensley has been transferred from the engineering department of the Merchants' Heat & Light Company, Indianapolis, Ind., to the engineering department of the American Public Utilities Company, Grand Rapids, Mich.

Mr. F. Beeuwkes has been appointed electrical engineer of the Chicago, Milwaukee & St. Paul Railway Company, and is making his headquarters at Butte, Mont., where he will have much to do with the extensive mountain-division electrification of his company.

Mr. L. B. Cramer, for four years chief of the electrical lines of the Hill roads in the Northwest, has been appointed electrical engineer for the San Francisco-Oakland Terminal Railways, with offices at Oakland, Cal. He will have supervision of all matters pertaining to power.

Mr. L. O. Veser, chief engineer of the Mahoning & Shenango Valley Railway Light Company of Youngstown, Ohio, has tendered his resignation, effective April 1. Mr. Veser has been in the service of the company since 1909, previously to which time he was connected with various hydroelectric companies in Western States.

Mr. Robert Montgomery has been appointed new-business manager of the Louisville Gas & Electric Company. Mr. R. E. Flower, late of Mobile, has been appointed assistant manager. These gentlemen were guests at a recent dinner given in their honor at the Hotel Henry Watterson by Louisville employees of the Federal Sign System (Electric).

Mr. F. Miller has been chosen superintendent and manager of the Crawfordsville (Ind.) Electric Light & Power Company as successor to Mr. J. R. Thomas. Mr. Miller is a graduate of Purdue University and has acted as manager of the light and heating plants at Greenwood, Franklin, Seymour and Columbus for the Interstate Public Service Company.

Mr. J. H. Larmouth, consulting engineer of Toronto, Ont., has been appointed superintendent of the Edmonton (Alberta) Municipal Street Railway. Mr. Larmouth, who is at present in private practice in Toronto, will take up his new duties on the first of April. He succeeds Mr. W. T. Woodrofe, who resigned recently. Mr. Larmouth was engineer for the Peterboro (Ont.) Street Railway, which he built and managed for a number of years. He was general manager of the Electrical Power Company two years ago and is a graduate of McGill University.

Mr. Harry Reid, formerly vice-president and general manager of the Kentucky Utilities Company, Lexington, Ky., has been elected president of the company. He succeeds Mr. Martin J. Insull, Chicago, who is president of the Middle West Utilities Company, of which the Kentucky corporation is a subsidiary. Mr. Reid's headquarters will continue to be at Lexington. The Kentucky Utilities Company operates a number of electric-light properties in Kentucky and now has large plans for the construction of power plants in eastern Kentucky for the service of coal mines.

Mr. J. H. Trimingham has been appointed superintendent of power of the Sherbrooke Railway & Power Company, Sherbrooke, Que. Mr. Trimingham was graduated from the McGill University, Montreal, in 1908 in electrical engineering. He was attached to the electrical staff at the university as a demonstrator from 1908 to 1911. For the following eighteen months he was consulting engineer and superintendent of power of the Bermuda Electric Light, Power & Traction Company, Hamilton, Bermuda. During the latter part of 1913 he was engaged in work for the electrical commission of the city of Montreal.

Mr. W. S. Murray has been appointed by the New York, New Haven & Hartford Railroad Company consulting engineer in general charge of all electrical engineering and construction, reporting to President Huestis, with offices at New Haven. Mr. Murray, following the substantial completion of the construction of the system for complete electrical operation west of New Haven, will enter into closer relations with the railroad company. His jurisdiction will hereafter be extended to include also the electrical features of operation in addition to electrical construction. He will continue with the firm of McHenry & Murray in general consulting practice as before.

Mr. William A. Fox, one of the new vice-presidents of the Commonwealth Edison Company, was promoted from the position of secretary and treasurer. As vice-president Mr. Fox will have charge of finances, securities and claims, with supervision over the secretary and treasurer. Mr. Fox was born in Sandwich, Ill., in 1865 and has been employed by the Commonwealth Edison Company or its predecessor, the Chicago Edison Company, since 1893. For a long time he was secretary to President Insull and he has served as secretary and treasurer of the company for a number of years. Mr. Fox is a director in a number of public utility companies, including the South Side Elevated Railroad Company, the Metropolitan West Side Elevated Railway Company, the Northwestern Elevated Railroad Company, the Middle West Utilities Company and the Public Service Company of Northern Illinois.

Mr. John F. Gilchrist has been made vice-president in charge of the purchasing, stores, transportation and statistical departments by the recent executive changes in the Commonwealth Edison Company of Chicago. Mr. Gilchrist was born in Chicago in 1868 and has been connected with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, throughout his entire business career. He made a fine record as contract agent of the company, and in 1906 was promoted to be assistant to the president, a position which he held until promoted to the vice-presidency. Mr. Gilchrist has a number of outside business interests, being treasurer of the Federal Sign System (Electric), as well as vice-president of the Middle West Utilities Company. In 1911 and 1912 Mr. Gilchrist served as president of the National Electric Light Association. He is also vice-president of the Electric Vehicle Association of America and has served as a director of the Illuminating Engineering Society.

Mr. T. R. H. Daniels, who resigned as chief engineer of the Birmingham (Ala.) Railway, Light, Heat & Power Company, has been appointed engineer of the Terre Haute, Indianapolis & Eastern Traction Company of Indianapolis, Ind. Mr. Daniels was at one time assistant engineer for Westinghouse, Church, Kerr & Company, of New York, in the construction of the new terminal station of the Pennsylvania Railroad. He left Westinghouse, Church, Kerr & Company to take charge of the rebuilding of tracks, etc., of

the United Railroads in San Francisco, after the earthquake, and in 1908 left San Francisco to become assistant engineer of the Terre Haute, Indianapolis & Eastern Traction Company. He acted as construction engineer in charge of the erection of the new West Tenth Street power station of that company at Indianapolis. In May, 1911, he left Indianapolis to become chief engineer for the Birmingham (Ala.) Railway, Light, Heat & Power Company, which position he has just relinquished to return to Indianapolis.

Mr. C. A. Thomas, the new manager of the Omaha office of the General Electric Company, has been connected with the General Electric Company and the Fort Wayne Electric Works for about fourteen years, with the exception of a year and a half, when he was engaged in other pursuits. Mr. Thomas was graduated from Cornell University in 1900 in the electrical engineering course and thereafter took the student's course at the Schenectady shops of the General Electric Company and a short course at the Lynn shops. He then became connected with the home office of the Fort Wayne Electric Works and later, for about three years, was manager of the Boston office of the Fort Wayne company. He was then transferred to Philadelphia and later was sent to St. Louis, where he was connected for four years with the office of the Fort Wayne Electric Works in that city and with the St. Louis office of the General Electric Company. About a month ago Mr. Thomas was promoted to be manager of the Omaha office of the General Electric Company.

Mr. R. E. Richardson, who recently resigned as general manager of the Commonwealth Power Company, Jackson, Mich., as announced in our issue of Jan. 31, was born at Concord, Mass., July 29, 1861. In 1885 he was graduated from the Massachusetts Institute of Technology, and after leaving school he spent five years with the Western Electric Company at Chicago. In 1889 he served as manager of the Milwaukee Electric Light Company. In 1892 Mr. Richardson laid out the lighting and wiring for the World's Fair at Chicago, and shortly after this he became a partner in the firm of Pierce, Richardson & Neiler. Subsequently he was engaged for ten years as general manager of the Kansas City Electric Light Company. Upon leaving that company in 1910 he made a commercial survey of 185 towns in Michigan within the present territory of the Commonwealth Power Company and the Consumers' Power Company and was later selected as general manager of the first-named company with thirty-two properties under his charge. Mr. Richardson will hereafter divide his time between general engineering work and the development of mineral and asphalt properties in the Southwest.

Mr. Van Rensselaer Lansingh, who as announced two weeks ago, was appointed manager of a recently organized department in the National Lamp Works of the General Electric Company, is well known in illuminating engineering circles, having been general secretary in 1906 and president in 1912 of the Illuminating Engineering Society. Mr. Lansingh graduated from the public schools of New York City and attended the College of the City of New York from 1888 to 1891. He is also a graduate of the University of Chicago and the Massachusetts Institute of Technology. He joined the testing department of the Western Electric Company February, 1899, and in July, 1900, formed the V. R. Lansingh Company in Chicago, sales agent for Holophane globes and reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of the General Electric Company, Cleveland. In the Johns Hopkins University course of lectures on Illuminating Engineering Mr. Lansingh gave the lecture on "Shades, Reflectors, and Diffusing Media." Mr. Lansingh has contributed to the technical literature of this and other countries. His book, "Practical Illumination," written in collaboration with Mr. J. R. Cravath, has had a wide circulation.

VAN RENSSELAER LANSINGH

Mr. Joseph H. Brewer, who was rceently elected president of the American Public Utilities Company of Grand Rapids, Mich., was born thirty-eight years ago in that city. At the age of fourteen he entered the employ of the Michigan Central Railroad as stenographer. At sixteen he was stenographer for the general superintendent of the Chicago & Western Michigan Railroad, and in 1891 he went to Detroit and opened a stenographic office for court reporting. In 1892 he returned to Grand Rapids, associating himself with Charles H. Bender, then the leading court stenographer in western Michigan. He retired from this partnership and devoted himself to the public utility business which he had inaugurated in 1904 by the purchase of the Holland (Mich.) Gas Company. Later he purchased the Winona (Minn.) Gas Light & Coke Company and the Red Wing (Minn.) Gas Light & Power Company. His work with these properties brought about an affiliation with Mr. Charles B. Kelsey, who controlled the Albion (Mich.) and Valparaiso (Ind.) gas companies. The new firm acquired several other properties, and in 1912 the American Public Utilities Company was formed as a holding company. The company has $20,000,000 preferred stock and $20,000,000 common stock, of which $4,000,000 of the preferred and $3,000,000 of the common have been issued.

Prof. H. H. Norris has accepted an appointment as associate editor of the *Electric Railway Journal*, and, beginning July 1, when his term as secretary of the Society for the Promotion of Engineering Education expires, he will devote his entire time to that publication. Widely known through his long connection with Cornell University, Professor Norris has also established a reputation for work in the electric railway field. He was superintendent of the tests conducted by the Electric Railway Test Commission at the St. Louis Exposition and later on the lines of the Union Traction Company of Indiana in Anderson, and with Prof. B. V. Swenson edited the report of the commission. He was also a member of the international jury at the St. Louis Exposition and secretary of the electric railway section. In 1905 his services were secured by the American Electric Railway Association to formulate plans for the reorganization of that association, and he drafted the constitution and by-laws which are now in effect. Professor Norris is a native of Philadelphia, and, after going through the Manual Training High School of that city, he took a course in physics and applied electricity at Johns Hopkins University as a special student. He afterward entered Cornell, where he was graduated with the degree of M.E. in 1896. He served as an instructor in Cornell from the time of his graduation to 1900, when he was made an assistant professor. In 1905 he was advanced to a professorship, which post he relinquished in 1913 to join the McGraw Publishing Company forces as a special contributor for the *Electrical World* and the *Electric Railway Journal*. During his last four years at Cornell he also had charge of the department of electrical engineering. Professor Norris has done a great deal of electrical work outside of the college in addition to that done in the railway field. He has for a number of years been chairman of the educational committees of the American Institute of Electrical Engineers and of the American Electric Railway Association and has just been appointed by the National Electric Light Association to the committee on relations of that organization to educational institutions. He was manager of the American Institute of Electrical Engineers from 1909 to 1912 and since 1909 has been secretary of the Society for the Promotion of Engineering Education. He is the author of several books dealing with electrical engineering subjects and of numerous contributions to the technical press.

H. H. NORRIS

Construction

New England

EAST JAFFREY, N. H.—The committee appointed to investigate the installation of a municipal electric-light plant recommends taking over the present system and securing electricity from the New Hampshire Wtr. & El. Pwr. Co. The town is now served by the Jaffrey & Troy El. Co.

ASHFIELD, MASS.—At the annual town meeting held recently it was voted to light the streets of the village with electricity.

HUNTINGTON, MASS.—The Huntington El. Lt. Co. expects to purchase within the next six months a few new poles. E. E. Stanton is superintendent.

PITTSFIELD, MASS.—The Board of Public Works has voted to instruct the Pittsfield El. Co. to place certain series wires underground on North and West Streets and around City Hall Park.

STERLING, MASS.—Within the next four months the electric light commission expects to erect some distributing lines and will require wire, transformers, insulators, meters, etc. Harrison W. Rugg is superintendent of lights.

Middle Atlantic

JAMESTOWN, N. Y.—Bids will be received by the board of electric light commissioners, Jamestown, until April 16 for furnishing and installing one 1000-kw turbine generator, condenser and switchboard panel in the municipal electric-light plant in accordance with specifications on file in the office of the board of electric light commissioners. For details see proposal columns.

NIAGARA FALLS, N. Y.—The Public Service Commission, Second District, has granted the Canadian-American Pwr. Corpn. permission to import electricity generated in Canada into New York State; it has also granted the application of the company to merge itself with the Niagara Falls Electrical Transmission Co. The former company proposes to take over a contract with the Electrical Development Co. for furnishing 46,000 electrical horse-power to be sold in the United States. Permission was asked to issue $3,000,000 in capital stock on account of the contract and $435,000 for the purchase of holdings of the Niagara Falls Electrical Transmission Co. The commission restricted the issue of stock to $1,000,000 and $250,000, respectively.

OSWEGO, N. Y.—Plans are being prepared by the People's Gas & El. Co., of Oswego, for extensive improvements to both its gas and electric plants. The company has filed a petition with the Secretary of State for permission to increase its capital stock from $600,000 to $1,000,000. The improvements to the electric plant will include extensions to the overhead system, additional generating apparatus and switchboard equipment. Roy F. Whitney is manager.

ROCKVILLE CENTER, N. Y.—The proposal to expend $16,000 for extensions and improvements to the municipal electric light plant will be submitted to the voters.

PRINCESS ANNE, MD.—Bids will be received at the office of the town commissioners until April 3 for lighting the streets of Princess Anne. The specifications call for 65 lamps of 85 cp to burn all and every night. The town is to have the privilege to have additional lamps installed at same rate per lamp per year. J. Douglass Wallop, Albert Krause and Columbus Lankford are commissioners.

CORRY, PA.—Preliminary plans, it is reported, are being prepared for a power house for the Inter-State El. Co., to cost about $300,000.

HARRISBURG, PA.—Bids are being received at the office of the Pennsylvania-Panama Pacific Exposition Commission, State Capitol Building, Harrisburg, for the electrical work on the Pennsylvania Pavilion at the Panama Pacific International Exposition to be held in San Francisco in 1915.

NEW CASTLE, PA.—The capital stock of the New Castle Steel & Iron Co. has been increased from $100,000 to $500,000. The proceeds, it is reported, will be used for installing machinery for electric steel welding. W. H. Schoen, of Pittsburgh, Pa., is interested in the company.

NORRISTOWN, PA.—The Counties Gas & El. Co., of Norristown, it is reported, is contemplating the construction of a one-story power house, 50 ft. by 64 ft.

PHILADELPHIA, PA.—Plans have been filed with the Bureau of Building Inspection by John T. Windrim, architect, for the new 15-story building, to be erected at Seventeenth and Arch Streets and the Parkway, for the Bell Telephone Co., at a cost of about $1,250,000.

PHILADELPHIA, PA.—The directors of the Pennsylvania Railroad have appropriated $300,000 to replace in vitrified-brick conduits 25 miles of telegraph and telephone wires torn down by the recent storm. Work will begin immediately between Rahway and Trenton. The conduits will have six ducts. Eventually, all wires of the company between New York and Pennsylvania will be placed in conduits.

ATLANTIC CITY, N. J.—The contract for the addition to the Steeplechase Pier, at Atlantic City, for George Tilyou, has been awarded to E. L. Bader, Bartlett Building, Atlantic City. The cost of the extension is estimated at $200,000 and calls for a large amount of electrical equipment for illuminating and power purposes.

CAMDEN, N. J.—Mayor Ellis will recommend that the City Council take some action to have all telephone and telegraph wires within the city limits placed in underground conduits.

CLAYTON, N. J.—The Borough Council has awarded Moore Brothers & Co., operating a glass-manufacturing plant, a contract for lighting the streets of the borough for a period of five years. The contract provides for the installation of 80-cp lamps on the main streets and 60-cp lamps on the side streets. Energy for operating the system will be supplied from the power plant in connection with the factory.

JERSEY CITY, N. J.—The Chamber of Commerce, it is reported, is negotiating for the installation of an improved street-lighting system along Grove Street. Ernest Rowe is secretary.

NEWARK, N. J.—The Common Council has approved the installation of a new engine and generator at the City Hall for auxiliary service, the cost not to exceed $6,000.

PERTH AMBOY, N. J.—The Board of Water Commissioners is considering the installation of an automatic electrically operated pumping plant (using water from the Raritan Bay) in connection with plans for the installation of a high-pressure salt-water system for fire, sprinkling, etc.

WILMINGTON, DEL.—The New Castle County Building Commission has engaged Palmer, Hornbostel & Jones, architects, of New York, to prepare plans and take charge of the construction of the new combined city and county building, to be erected at Tenth and King Streets, at a cost of $1,000,000. The new building will be equipped with the most improved electrical devices, for which contract has not yet been awarded.

BALTIMORE, MD.—The Consol. Gas, El. Lt. & Pwr. Co., of Baltimore, has applied to the Public Service Commission for permission to issue $1,106,800 in debenture stock, the proceeds to be used for construction purposes.

CUMBERLAND, MD.—Application has been made to the State Legislature by the Edison El. Illg. Co. and the Cumberland El. Ry. Co. for a charter allowing them to consolidate, with a capital stock of $1,000,000. As soon as spring opens, it is said, the consolidated company will begin work on the construction of an electric generating plant to cost about $40,000. The present plans provide for an ultimate installation of 11,000 kw, although the initial installation will be but 5000 kw. The old Union Street station, owned by the Edison El. Illg. Co., will be used as a distributing station, and also to supply steam for the company's steam-heating plant, which now covers the main business streets of the city. The company also proposes to enlarge and extend the street railway service.

EASTON, MD.—The State Senate has passed the bill authorizing the municipality of Easton to issue bonds for the installation of an electric-light and power plant.

ABINGDON, VA.—The Abingdon Wtr. & Lt. Co. may purchase a boiler within the next six months.

ELKTON, VA.—The Valley Pwr. Co., Elkton, recently incorporated with a capital stock of $100,000 (maximum), is building a 1300-hp hydroelectric power plant on the Shenandoah River, near Grove Hill, at a cost of from $50,000 to $60,000. The company will furnish electricity in Elkton, Shenandoah City and Stanley for lamps and motors. It also has submitted a proposal to furnish electricity in Harrisonburg. H. W. Bertram, of Harrisonburg, has been appointed attorney of record in Virginia.

KENBRIDGE, VA.—Steps have been taken by the Business Men's Association to secure the establishment of an electric-light plant and telephone system in Kenbridge.

WASHINGTON, D. C.—Bids are requested by the Direccion General de Obras Publicas, Ministerio de Fomento, Madrid, Spain, for the concession and construction of an electric tramway in Madrid. The cost of the tramway is estimated at $22,935, and the rolling stock must include two cars. For further information address No. 12701 Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Experiments are now being made on a railway operating between two foreign cities with electric generators and accumulators for lighting trains. Tests have been going on for some time, two trains having been fitted out, and it is not yet known whether either system will be adopted or other systems will be invited to make experiments. An American consulate officer furnishes the name of the railway in question and states that correspondence in regard to other systems of lighting should be addressed in Spanish. For further information address No. 12,561, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or branch offices of the bureau, 315 Custom House, New York, N. Y.; 629 Federal Building, Chicago, Ill.; Association of Commerce Building, New Orleans, La., and 76-78 Appraisers' Stores Building, San Francisco, Cal.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 7, for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 6537—53 mast arc arms, three single-phase transformers; Schedule 6536—cross-arms for electric-light poles. Brooklyn, N. Y., Schedule 6534—miscellaneous switches, frogs, etc., 51,000 lb. black-annealed wire; Schedule 6545—480 1¼-in. composition unions, 3320 lb. naval bar brass, 1000 lb. phosphor copper in 5-lb. ingots. Boston, Mass., Schedule 6545—miscellaneous copper pipe. Bids will also be received until April 14 as follows: For 2300 ft. conveyor belt to be delivered at the Brooklyn navy yard as per Schedule 6529. Applications for proposals should give the schedule desired by number. J. T. Cowie is paymaster-general, U. S. N.

North Central

BELDING, MICH.—Contract has been awarded by the Spencer El. Co., of Belden, for rebuilding its Smyrna water-power plant and penstocks to Brice Brothers, of East Jordan. The work includes 525 yd. of reinforced concrete, 9 tons of structural steel and 8 tons of reinforcing steel. The Fargo Engineering Co., Commonwealth Building, Jackson, has charge of the engineering work.

CLIO, MICH.—Within the next two months J. H. O'Rourke, owner of the local electric-light plant, expects to purchase a new steel smokestack, 34 ft. high by 40 in. in diameter.

DETROIT, MICH.—An electric elevator will be installed in the new addition to the plant of the Abbott Motor Car Co.

FLUSHING, MICH.—Within the next 60 days the Hart Milling & Pwr. Co., of Flushing, expects to erect power house, etc., and to purchase within the next three months poles for distribution system. R. O. Hart is manager.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, has awarded contract for construction of concrete spillway and penstocks to remodel its present hydroelectric plant in Greenville to Brice Brothers, of East Jordan. The Fargo Engineering Co., Commonwealth Building, Jackson, has charge of the engineering work.

HARBOR BEACH, MICH.—The Harbor El. Co., of Harbor Beach, expects to purchase within the next 12 months six ornamental lamp standards and lamps to meet requirements; also electrical appliances and supplies as needed. B. F. Huestis is secretary and treasurer.

HARBOR SPRINGS, MICH.—The Board of Electric Light Commissioners expects to purchase within the next three months transformers and meters; also, within the next six months to purchase material for about 2 miles of distribution lines, including poles, lightning arresters, insulators, cable, wire, etc., and electrical appliances and supplies of all kinds. W. D. Wright is clerk.

HASTINGS, MICH.—The Thornapple Gas & El. Co., of Hastings, expects to erect within the next four months a new concrete substation to replace the present substation at Lake Odessa, and to purchase 25,000-volt outdoor switches; also within the next two months to purchase a carload of poles. The company has just renewed the street-lighting contract for a period of five years, calling for additional street lamps. L. W. Heath is general manager.

ISHPEMING, MICH.—The Marquette County Gas & El. Co., of Ishpeming, ex-

pects to erect within the next six months a 4-mile extension to its transmission lines. A. C. Harrington is general manager.

JACKSON, MICH.—The State Railroad Commission has granted several companies permission to issue bonds, as follows: The Flint El. Co., of Flint, $4,000; Saginaw Pwr. Co., of Saginaw, $14,000; Bay City Pwr. Co., of Bay City, $1,000; Commonwealth Pwr. Co., of Jackson, $189,000; Au Sable El. Co., of Au Sable, $14,000; Economy Pwr. Co., of Jackson, $5,000; Consumers' Pwr. Co., of Pontiac $2,000, and the Grand Rapids-Muskegon Pwr. Co., of Grand Rapids, $189,000. The proceeds are to be used for extensions and improvements to the properties of the above companies.

KALAMAZOO, MICH.—The contract for the power installation in the factory of the Western Paper Makers Chemical Co. is reported to have been awarded to Fred J. Hotop.

MILFORD, MICH.—The Milford El. Co. expects to erect within the next six months 20,000 ft. No. 2 stranded medium hard-drawn bare copper wire and to install one 40-in. vertical waterwheel (open penstock type); also to purchase one 150 kva or 200-kva, three-phrase, 60-cycle, 2300-volt generator with directly connected exciter (belted type), 600 or 900 r. p. m., or a 150-kva or 200-kva (same as above) vertical umbrella type generator; one waterwheel generator for above waterwheel, 25 lightning arresters (2300-volt, pole type), electric ranges and various cooking devices. C. C. Sherk is superintendent.

PARKVILLE, MICH.—Funds are being raised by popular subscription for the installation of a power plant. The place is not incorporated and therefore cannot issue bonds.

BELMONT, OHIO.—The Dayton Pwr. & Lt. Co., of Dayton, has been awarded a contract to light the streets of Belmont. The contract provides for 25 75-watt lamps. Work will begin on the installation of the system about April 1.

CLEVELAND, OHIO.—Contracts, it is reported, will soon be awarded by the Independent Towel Supply Co. for a four-story factory building. The company will install its own power plant. Contract for equipment has not yet been awarded.

CLEVELAND, OHIO.—The city officials and architects, it is reported, have decided to build the power plant for the new City Hospital buildings before other improvements are made. It is proposed to have the power house in operation by Oct. 1.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, director of public service, 513 City Hall, Cleveland, until March 27 for induction voltage regulators for the municipal electric-light plant. Specifications are on file at the office of commissioner of light and heat division, 1443 Third Street, Cleveland.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Ry. Co. for the erection of four new buildings at different points on its lines, the combined cost to be about $130,000. There will be three operating stations and a shop building. Morrow & Gross, Garfield Building, are architects.

COLUMBUS, OHIO—An electric-motor and a motor-driven pump will be installed in the East Side pumping station at a cost of $4,275 by the Weinman Pump Mfg. Co.

COLUMBUS, OHIO.—Plans are being considered relative to the practicability of utilizing the water at the storage dam for power to be used in operating the various municipal plants of the city.

COLUMBUS, OHIO.—Bids will be received by Samuel Kinnear, director of public service, until March 31 for furnishing two 250-kva, single-phase, oil-insulated, self-cooled, 6600/440-volt transformers, in accordance with specifications on file in the office of the director of public service and the superintendent of the division of sewage disposal, water-works office, City Hall, from whom copies may be obtained.

KENT, OHIO.—Investigations are being made by Mayor M. L. Davy of municipal ownership of lighting plants throughout the State of Ohio with a view of recommending the installation of a municipal plant in Kent to the City Council.

MASSILLON, OHIO.—Plans have been completed by the Massillon Rolling Mill Co. for a new open-hearth steel plant, which will be operated by electricity. The plans include three 50-ton furnaces, a bar mill and a blooming mill. The contract for electrical equipment has been placed with the Westinghouse El. & Mfg. Co., of Pittsburgh.

NORWOOD, OHIO.—Bids will be received by the director of public service, Norwood, until April 7 for any or all branches of work for the construction of a city hall, including electric work, in accordance with plans and specifications prepared by Weber, Werner & Adkins, architects, Cincinnati, which are on file in the office of the director of public service, Norwood, at the Builders' Exchange, Cincinnati, and at the office of the architects, 1206 Mercantile Library Building, Cincinnati. Harry J. Pierson is director of public service.

OAK HARBOR, OHIO—Bids will be received by Louis L. Carstensen, clerk of Board of Trustees of Public Affairs, Oak Harbor, until April 15 for furnishing material and construction of an electric-light system. Plans and specifications are on file in the office of the clerk of board and also in the office of Vance I. Gray, electrical engineer, Toledo. For details see proposal columns.

ORRVILLE, OHIO.—The Massillon El. & Gas Co., of Massillon, has secured a temporary injunction to restrain the village of Orrville from erecting a municipal electric-light plant. The company recently completed a transmission line to Orrville costing $25,000. It claims that the village made no effort to purchase the company's present equipment.

WORTHINGTON, OHIO.—Bids, it is reported, will soon be asked for the erection of lamp posts (for cluster lamps) and wiring, covering a distance of about 2½ miles, to connect this village with the boulevard lighting system extending northward from Columbus for about the same distance.

YOUNGSTOWN, OHIO.—A special committee has been appointed by the City Council to make investigations in regard to securing a better street-lighting system for the city.

YOUNGSTOWN, OHIO.—Estimates place the cost of putting the wires of the Consol. Gas & El. Co. on Federal Street underground at $75,000. Only wires carrying electricity for lighting purposes will be placed underground. Conduits were installed on Federal Street several years ago.

BARLOW, KY.—A company has recently been organized for the purpose of furnishing electricity in Barlow. The plans provide for the installation of a 25-hp engine and a 15-kw generator.

LEXINGTON, KY.—The Federal Parquet Mfg. Co., of New York, which is planning to install a plant in Lexington, has decided to equip its factory with electrically operated machinery.

LOUISVILLE, KY.—Preparations are being made by the Louisville & Nashville R. R. Co. for the installation of considerable mechanical equipment, a large portion of which will be operated by electricity.

LOUISVILLE, KY.—Plans are being prepared by Ward Baldwin, consulting engineer, Cincinnati, Ohio, for equipping the plant of the American Oak Leather Co., in Louisville, for electrical operation. Contracts, it is understood, will soon be awarded by B. M. Henry, manager of the Louisville plant, for generator, motors and other necessary equipment.

ASHLEY, IND.—The Board of Trustees has purchased a 60-hp high-speed engine (to be delivered April 1) for the municipal electric-light plant. George W. Caryl is superintendent.

EVANSVILLE, IND.—The board of directors of the Young Men's Christian Association, it is reported, has decided to install a power plant in connection with the new building now under construction. The building committee, consisting of Dr. J. C. McClurkin, G. A. Trimble, C. H. Battin, W. B. Miller and A. F. Karges, has been authorized to ask for bids for the plant immediately.

HUNTINGTON, IND.—F. M. Bowers, city attorney, has filed a petition with the State Board of Public Utilities asking permission to rebuild and enlarge the municipal electric-light plant.

MENTONE, IND.—Messrs. Holland & Davis, owners of the local electric-light plant, have purchased the lighting system in Murray, Ia. W. P. Hollands will have charge of the Murray plant and W. C. Davis of the Mentone system.

PORTLAND, IND.—Arrangements are being made by the Commercial Club and the City Council for the installation of a new street-lighting system (cluster lamps) in the business section.

OREGON, ILL.—An agreement has been reached between the city of Oregon and the Illinois Northern Utilities Co., of Oregon, whereby the latter will build a dam across the Rock River at a cost of about $78,000.

SYCAMORE, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 3 for construction, complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Sycamore, Ill. Drawings and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

WASHBURN, ILL.—Within the next six months the Washburn, Ht., Lt. & Pwr. Co. expects to erect 4 miles of three-phase transmission line; also within the next three months to purchase a coaling system, delivering coal by trolley from switch to power house. W. E. Lycan is president and manager.

WATAGA, Ill.—The managers of the Wataga Mill and Light plant expect to extend its transmission line into the rural district and to purchase wire, poles, transformers, meters and other line material within the next three months. H. J. Kunkle is manager.

ANTIGO, WIS.—The Antigo El. Co. will install a new Lyons boiler (90 in. by 18 ft.), contract for which has been awarded. Reported in the issue of March 7 to be contemplating improvements to plant.

ELDORADO, WIS.—The Town Board has granted the Wisconsin Lt., Pwr. & Milling Co. a franchise to construct and operate an electric-light and power plant in Eldorado.

NORTH FREEDOM, WIS.—Within the next twelve months A. H. Voeck, proprietor of the city lighting plant, expects to purchase from 20 to 30 meters.

PRAIRIE DU SAC, WIS.—At an election held recently the proposal to purchase the property of the Prairie du Sac Mill & Lt. Co. was carried. Necessary changes will be made by the village for the distribution of electricity for lamps and motors from the dam.

WYOCENA, WIS.—The property of the Columbia County Lt. & Pwr. Co., of Wyocena, was taken over by a receiver last December and will be sold within a few weeks. J. H. Dooley is receiver.

CHASKA, MINN.—Arrangements are being made by the city of Chaska to install 36 ornamental lamp-posts for five-lamp clusters, connected up with steel-taped cable. The posts will be installed some time in April. E. F. Strong is manager of the municipal electric-light plant.

CHISHOLM, MINN.—The Chisholm Electrical Co. has purchased one 600-kw General Electric turbine and three switchboard panels. The company expects to purchase miscellaneous line material and also miscellaneous heating equipment and cooking utensils. R. M. Heskett is manager.

COMFREY, MINN.—The town of Comfrey is considering the question of establishing a municipal electric-light plant.

COTTONWOOD, MINN.—The installation of an electric-light plant in Cottonwood is under consideration. W. F. Mullaney, of Marshall, is interested in the project.

DULUTH, MINN.—The Western Mesaba El. Co., of Duluth, recently incorporated with a capital stock of $100,000, will erect 40 miles of 2200-volt transmission line from Hibbing to Grand Rapids, Minn., using 35-ft. to 45-ft. poles. F. McCormack, 2015 East Second Street, Duluth, is president of the company.

EVELETH, MINN.—The City Council is considering the question of establishing a municipal electric-light plant. It is understood that the local electric-light plant can be purchased. The St. Louis Pwr. Co. has submitted a proposal to furnish electricity to the city.

FAIRMONT, MINN.—Within the next three months the board of electric light commissioners expects to purchase poles and probably underground conduit for the municipal distribution system. Alfred Horne is manager.

GOOD THUNDER, MINN.—Plans are being considered, it is reported, by the Commercial Club for the installation of an electric-light plant in Good Thunder. A. W. Seaquist is president of the Commercial Club.

HOLDINGFORD, MINN.—The Holdingford Milling Co. is reported to have submitted a proposal to the town officials offering to install an electric-lighting plant. For further information address Alexander Lemmer.

MONTEVIDEO, MINN.—The Montevideo El. Lt. & Pwr. Co., it is reported, contemplates extending its system from Sacred Heart to Clara City. J. F. Druar, of the Oscar Claussen Engineering Co., of St. Paul, is consulting engineer.

MOORHEAD, MINN.—The City Council is considering the question of calling an election to submit to the voters the proposal to issue $20,000 in bonds for improvements to the municipal electric-light and water plant. It is proposed to install a 500-kw generating unit, which will more than double the output of the plant.

PIPESTONE, MINN.—The Pipestone El. Lt., Ht. & Pwr. Co. expects to purchase within the next three months 24 or more ornamental lamp standards for five-lamp clusters and 2000 ft. of No. 8 three-wire steel-taped cable. J. W. Campbell, Jr., is superintendent.

WARREN, MINN.—Plans are being considered for increasing the output of the municipal electric-light plant. Contract will be awarded March 23 for the erection of a concrete chimney 80 ft. high by 4 ft. in diameter. W. R. Haney is superintendent.

BLOOMFIELD, IA.—Plans are being considered to rebuild the municipal electric-light plant at a cost of about $15,000.

DES MOINES, IA.—Plans are being considered to establish a municipal telephone system in Des Moines, to cost $2,020,000.

FOREST CITY, IA.—The Forest City El. Lt. & Pwr. Co. has recently moved into its new power house, which is equipped with a new boiler, engine, generator and marble switchboard. Frank Kellogg is president.

LITTLE ROCK, IA.—Contracts will be awarded by the Little Rock El. Lt. Co. for the construction of its proposed plant about April 1. As yet plans have not been completed. W. H. Grover, of Ames, Ia., is engineer in charge of the work.

McGREGOR, IA.—The State Railroad Commission has granted G. S. Donaldson, owner of the McGregor electric-light plant, a franchise to erect a high-tension transmission line from McGregor to Monona and intermediate points. The proposed line will be about 14 miles long and will furnish electricity to residents along the route.

MURRAY, IA.—The local electric-lighting system has been purchased by Messrs. Hollands & Davis, of Mentone, Ind. No extensions or improvements will be made at present. W. P. Hollands will have charge of the Murray plant.

NORA SPRINGS, IA.—O. E. Jacobson, owner of the local electric-light plant, is contemplating the installation of two new generators and oil engines.

LIBERTY, MO.—Application has been filed with the Public Service Commission by the Missouri Gas & El. Co., of St. Louis, asking for permission to purchase the property of the Liberty El. Lt. & Pwr. Co. The Missouri company has recently purchased the lighting plants in Lexington, Richmond, Hardin and Henrietta.

POPLAR BLUFF, MO.—The City Council has decided to submit the proposal to issue $75,000 in bonds to establish a municipal lighting plant to the voters.

STE. GENEVIEVE, MO.—Within the next four months the Home Lt. & Wtr. Co., of Ste. Genevieve, expects to erect a 11,000-volt transmission line to furnish electricity in the town of St. Mary, 9 miles distant. Guy E. Paxton is superintendent.

ST. JOSEPH, MO.—The Public Service Commission has granted the St. Joseph Ry., Lt., Ht. & Pwr. Co. authority to issue $162,000 in bonds, the proceeds to be used for extensions and improvements.

SPRINGFIELD, MO.—Bids will be received by the board of directors of the school district of Springfield until April 8 for construction of a two-story school building at the corner of George and Fremont Streets as follows: (a) For building complete; (b) heating and ventilation; (c) plumbing; (d) interior cement finish; (e) electric wiring. Plans and specifications are on file in the office of O. L. Brettner, architect, Springfield, copies of which may be obtained upon deposit of $5. A. D. Allen is secretary of board of education.

SUMNER, MO.—A franchise, it is reported, has been granted to a syndicate to construct and operate an electric-light plant in Sumner.

ELLENDALE, N. D.—The City Council has granted J. L. Tucker a franchise to construct and operate an electric-light plant in Ellendale for a period of 30 years. The Council has entered into an agreement with the company for street-lighting to the amount of $1,500 per year. By mistake this appeared under Ellendale, S. D., in the issue of March 7.

NEW SALEM, N. D.—Application has been made to the City Council by Charles F. Peterson for a franchise to furnish electricity in New Salem for lamps and motors. It is understood that Mr. Peterson proposes to purchase electricity from the plant of the Dakota Coal Products, located at its mine near this city.

ELK POINT, S. D.—At an election held recently the proposal to issue $25,000 in bonds for the installation of a municipal electric-light plant was carried.

ELKTON, S. D.—We are informed that no bonds have been authorized for the installation of a municipal electric-light plant in Elkton. Reported in the issue of March 7 to have voted to issue $25,000 in bonds for the construction of a municipal plant.

DECATUR, NEB.—The Village Board has awarded the contract for installation of the municipal electric-light plant to Frank H. Wheeler, of Lincoln, Neb., at $4,575.

FORT CALHOUN, NEB.—At a special election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

LINCOLN, NEB.—A petition has been presented to the city commission asking that an election be held to vote on the proposal to issue $200,000 in bonds for extensions and improvements to the municipal electric-light plant.

SIDNEY, NEB.—The Council is reported to have engaged Prof. V. L. Hollister, University of Nebraska, Lincoln, to prepare plans and estimates of cost of the installation of an electric-light plant in Sidney.

CLAFLIN, KAN.—The Claflin Tel., Lt. & Garage Co. is contemplating the installation of a storage-battery plant to take care of the light-load periods. E. R. Ruch is owner and manager.

JETMORE, KAN.—The contract for construction of the municipal electric-light plant and water-works system is reported to have been awarded to W. P. Bullock, of Kansas City, Mo.

HORTON, KAN.—Bids will be received by the Mayor and Council of the city of Horton at the office of B. B. Norris, city Clerk, until March 24 for the erection of a city hall and fire department, in accordance with plans and specifications prepared by Holland, Gamble & Holland, architects, Topeka, which are on file in the office of the city clerk, Horton, and in the office of the architect, Topeka. Separate bids will be received for steam heating, plumbing and electric wiring. By mistake this was published under Holton, Kan., in the issue of March 14.

Southern States

SILER CITY, N. C.—The capital stock of the Siler City Lt. & Tel. Co. has been increased to $25,000.

TARBORO, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 15 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Tarboro, N. C. Drawings and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

WARSAW, N. C.—The Council has awarded a contract for street-lighting to J. W. Petty, of the East Carolina Lt. & Pwr. Co. About 25 tungsten high-candle-power lamps will be installed.

CAMDEN, S. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 21 for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Camden, S. C. Drawings and specifications may be obtained from the custodian of site at Camden or from the above office. O. Wenderoth is supervising architect.

BRUNSWICK, GA.—The Mutual Lt. & Wtr. Co., it is reported, contemplates the construction of a new electric-light plant.

DILLARD, GA.—The Rabun Colony Club has awarded a contract for construction of an electric-light plant to the Mackle-Crawford Con. Co., Grant Building, Atlanta. The work will include construction of dam. Ray Harris, of Atlanta, is president of club.

MACON, GA.—The Central Georgia-Carolina Pwr. Co., of Macon, has closed contracts to furnish electricity to operate the large cotton factories of the Aiken Mfg. Co., of Aiken, S. C., and the Seminole Mfg. Co., of Clearwater, S. C. It is estimated that 1000 hp will be required.

ST. GEORGE, GA.—The installation of an electric-light plant, ice factory and cold-storage plant in St. George is under consideration. N. J. Norman is reported to be interested in the project.

BARTOW, FLA.—At an election held Feb. 17 bonds to the amount of $44,000 were voted, of which the proceeds of $20,000 will be used for improvements to the municipal electric-light plant, $6,000 for water-works' extensions, and $17,000 for city hall. D. E. Bivins, superintendent of the electric-light plant, will probably have charge of the improvements to electric and water plant. As yet bonds have not been offered for sale. B. J. Oeland is city clerk.

JACKSONVILLE, FLA.—Bids will be received by the Board of Bond Trustees of the city of Jacksonville until April 8 for furnishing the necessary lamps to supply the needs of the municipal electric-light plant for one year. The cost is estimated at approximately $2,500. Lamps will be required of 100/115 volts, multiple type, also 75/100 volts, street series type, 4.3 amp to 4.5 amp, to be shipped as needed. For further information address R. N. Ellis, purchasing agent.

PALATKA, FLA.—The Palatka Gas. Lt. & Fuel Co. has submitted a proposition to the city of Palatka offering to sell its electric plant to the city. G. Lopez Bailey is president of the company.

TALLAHASSEE, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 13 for a conduit and wiring system and lighting fixtures and plumbing repairs at the United States court house and post office at Tallahassee, Fla. For details see proposal columns.

DICKSON, TENN.—An election will soon be held to vote on the proposal to issue $15,000 in bonds, part of the proceeds to be used for extending the electric-lighting system into the new districts recently acquired by the city.

NASHVILLE, TENN.—The Nashville Trac. Co., it is reported, contemplates the erection of an electric power plant to supply electricity to operate the traction system and for commercial purposes.

OAKWOOD, TENN.—The proposal to issue $50,000 in bonds for street improvements, lighting municipality and building sewers is under consideration by the Board of Commissioners. Oakwood is a suburb of Knoxville.

MOBILE, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 16 for construction, including mechanical equipment, lighting fixtures and approaches of the United States post office at Mobile. Drawings and specifications may be obtained at the above office or from the office of the custodian at Mobile. O. Wenderoth is supervising architect.

MONTGOMERY, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 20 for a hydraulic lift, pumping plant, miscellaneous repairs, etc., in the United States post office in Montgomery, Ala. For details see proposal columns.

CARROLLTON, MISS.—Within the next three months the electric light commissioners expect to extend the municipal lighting system over the railroad to North Carrollton; also to purchase from 3500 ft. to 4000 ft. of No. 1 weatherproof wire and 2000 ft. No. 8 or No. 10 weatherproof wire and necessary cross-arms, etc. W. E. Stilson is manager.

OKOLONA, MISS.—The Mississippi El. Co., recently organized with a capital stock of $5,000,000, is planning the construction of an electric railway from Okolona, Miss., to Aliceville, Ala., a distance of 70 miles. The charter of the company also gives it the right to distribute electricity for lamps and motors and to furnish gas.

TYLERTOWN, MISS.—The property of the Tylertown Lt. & Pwr. Co. has been purchased by T. C. Simmons and W. A. Boyd, of Tylertown. The new owners, it is understood, will enlarge and improve the plant.

WAYNESBORO, MISS.—The plant of the Waynesboro Electrical Co. will be operated by water-power. A steam plant, consisting of engine, boiler and generator (second-hand) is being installed for use in emergencies. A transmission line about 2 miles long will be required to reach the town. The cost of the plant is estimated at about $6,000. J. A. Leggett is secretary.

CLARKSVILLE, ARK.—Bonds to the amount of $20,000 have been sold for the installation of an electric-light system in Clarksville.

HEBER SPRINGS, ARK.—The Arkansas Hydro-Electric Co., of Heber Springs, which proposes to build a hydroelectric plant on the Little River, near here, has engaged C. V. Smith, engineer, Kahn Building, Little Rock, to take charge of the work. Plans are not yet completed for the proposed plant. U. S. Bratton is secretary.

LITTLE ROCK, ARK.—The State Capitol Commission, it is reported, has awarded a contract for construction of power house and heating plant for State Capitol building to T. T. Riddick & Co., of Fort Smith, Ark., at $37,779.

RUSSELLVILLE, ARK.—Preparations, it is reported, are being made by the Seven Cities Co., of St. Louis, which recently purchased the plant of the Russellville Wtr. & Lt. Co., for enlarging the hydroelectric power plant and extending the transmission lines to nearby towns to furnish electricity for lamps and motors. Henry M. Bowen, of St. Louis, is secretary.

BRISTOW, OKLA.—Application has been made to the City Council by W. T. Brady, of Tulsa, for a franchise to construct and operate an electric-light plant in Bristow. The city has already voted to issue $25,000 in bonds to construct a municipal plant, but it is understood that the Council favors granting a franchise to private parties.

MUSKOGEE, OKLA.—The new contract between Samuel Brown, Jr., who proposes to build the Grand River dam to furnish power to operate a hydroelectric power plant, and the Muskogee Wtr. Pwr. Co. has been executed. All that is now needed to insure the construction of the dam is a franchise, which will be submitted to the voters.

ALPINE, TEX.—The local power plant, ice factory, etc., is reported to have been purchased by George Miller, of Marathon, for $10,000.

BEAUMONT, TEX.—Extensions and improvements involving an expenditure of $100,000 will be made to the local electric-power plant, street-railway system and carhouses owned and controlled by the Stone & Webster Engineering Corpn., of Boston, Mass. The improvements will include the installation of a 2000-kw turbo-generator set, a 600-hp boiler, one 500-kw motor-generator set for street railway service and necessary auxiliaries at power plant.

BELLEVUE, TEX.—The Council is reported to have granted the Hiram Grosman Lt. & Pwr. Co., of Dallas, a franchise to operate an electric-light system in Bellevue. The company is now erecting a transmission line from Dallas to Wichita Falls, through Decatur, Alvord, Sunset, Bowie, Bellevue and Henrietta.

CLEBURNE, TEX.—The Cleburne St. Ry. Co. is replacing its wooden poles in the business district with ornamental iron poles on which lamps will be placed by the city.

DENTON, TEX.—The Fort Worth-Denton Co. has completed a new survey for the proposed Denton-Fort Worth interurban railway. The directors will soon decide whether the route will be via Justin or Roanoke.

EL PASO, TEX.—The capital stock of the El Paso El. Co. has been increased from $3,000,000 to $4,000,000.

KILGORE, TEX.—Preparations are being made for the installation of an electric-light plant to furnish electricity in Kilgore and suburbs.

PITTSBURG, TEX.—The People's Lt. & Ice Co., recently organized, proposes to construct an electric and ice plant.

SWEETWATER, TEX.—The Sweetwater Lt. & Pwr. Co. is reported to be contemplating extending its lines to Lorain and Roscoe to furnish electrical service in those towns.

Pacific States

PASCO, WASH.—The City Council has instructed City Attorney Ryzek to make investigations relative to the cost of installing a municipal electric-light plant. The validity of installing a municipal telephone system is being investigated at present.

BAKER, ORE.—The City Council has instructed Municipal Lighting Engineer Stannard and City Commissioner Finley to prepare plans and estimates for the extension of the municipal lighting system to certain sections of the city. The Council has decided to replace eventually all arc lamps now in use with tungsten lamps. Bids will be asked for material for the extensions as soon as plans are approved by the Council.

CANBY, ORE.—M. J. Lee, of Canby, it is reported, is contemplating the construction of a power plant near Molalla, to cost $25,000, this spring.

DREWSEY, ORE.—Final plans and surveys have not been completed for the proposed hydroelectric irrigation in this section. John E. Johnson & Sons, engineers and contractors, of Drewsey, are interested in the project.

PORTLAND, ORE.—The stockholders of the Northwestern El. Co., of Portland, on April 8 will vote on a proposition to increase the capital stock of the company to $12,000,000.

AZUSA, CAL.—At an election held March 4 the proposal to issue $55,000 in bonds for extensions and improvements to the municipal light and water plant was carried.

BURNEY FALLS, CAL.—The State Railroad Commission has authorized the Pitt River Pwr. Co., of Burney Falls, to sell $15,000 in stock, to be sold at not less than 80, the proceeds to be used for the development of the company's hydroelectric system at Burney Falls.

EUREKA, CAL.—The Western States Gas & El. Co., of Eureka, is contemplating the erection of 25 miles of additional transmission lines, including a new line between Eureka and Ferndale and one to the Table Bluff lighthouse.

LOS ANGELES, CAL.—The State Railroad Commission has authorized the San Fernando Mission Land Co., of Los Angeles County, to sell its electric plant to the Pacific Lt. & Pwr. Corpn., of Los Angeles, for the sum of $7,835. John T. Wilson has also received authority to sell his electric distributing system in San Fernando to the Pacific Lt. & Pwr. Corpn. for $16,000.

OXNARD, CAL.—The Ventura County Pwr. Co., of Oxnard, has filed application with the State Railroad Commission to issue notes to the amount of $200,000, the proceeds to be used for additions and improvements to its system.

SAN DIEGO, CAL.—The city engineer has recommended to the City Council the installation of 50 additional arc lamps to be erected in different parts of the city.

SAN FERNANDO(CAL.—The Maclay Rancho Wtr. Co. and the Consol Securities Co. have been granted permission by the State Railroad Commission to sell their electric-light system in the city of San Fernando to the Southern California Edison, of Los Angeles, for $9,000.

SAN FRANCISCO, CAL.—A new company is being formed, to be known as the San Francisco & Northern Ry. Co., to reorganize the Petaluma & Santa Rosa R. R. Co. and to provide direct service between San Francisco and Healdsburg.

CULDESAC, IDAHO.—H. W. Whitcomb, of Portland, Ore., and W. L. Mars, of Cœur d'Alene, it is reported, are negotiating for the old lighting plant, owned by E. P. Atkinson, of Culdesac. If the deal is consummated new machinery will be installed and the plant placed in operation.

LOGAN, UTAH.—The board of electric light commissioners expects to purchase within the next six months lamp-posts for the newly paved district. H. C. Manyhan is superintendent.

FLAGSTAFF, ARIZ.—William Randolph Hearst, it is reported, is planning to build an electric railway from Flagstaff to the rim of the Grand Canyon, a distance of 80 miles. He recently purchased the Grand View Hotel, 6 miles east of the E. Trovar Hotel, and will either erect another large hotel or enlarge the present one.

LIVINGSTON, MONT.—The installation of an ornamental street-lighting system is being considered by the Municipal Ownership League. Joseph Brooks is president of the league.

MELSTONE, MONT.—The City Council has granted C. H. Bennett, of Spokane, Wash., a franchise to construct and operate an electric-light plant in Melstone.

DOUGLAS, WYO.—Within the next three months the Douglas El. Lt. Co. expects to erect a new power house, 42 ft. by 80 ft., and to purchase some transformers and line material. The company is changing its system from 110 volts direct current to three-phase, 60-cycle, 2300-volt alternating current. Contracts have been placed for one 72-in. by 18-ft. Kewanee return-tubular boiler, two 75-kva, one 125-kva General Electric generator, directly connected to Ball Corliss engines, and for a five-panel General Electric switchboard. E. A. Collins is general manager.

SHOSHONI, WYO.—The Shoshoni Light & Power Company contemplates extending its lines during the coming year, but as yet no definite plans have been made. The hydroelectric plant of the company is operated by the Fremont Power Company under lease. Harry Bolster is manager.

LITTLETON, COL.—Within the next few months the Arapahoe El. Lt. & Pwr. Co., of Littleton, expects to reinforce about 3 miles of high-tension transmission line. The company has recently opened an office in Englewood, also a supply department with a full line of electrical cooking and heating apparatus. O. F. Nats is superintendent.

GOLCONDA, NEV.—Permission has been granted by the County Commissioners to J. B. Fayant to construct and operate an electric light and power plant in Golconda.

ELY, NEV.—Arrangements are being made by Benjamin W. Coleman to organize a company for the purpose of building hydroelectric plants on Cleve Creek to furnish electricity to pump water for irrigating 15,000 acres of land in Spring Valley. The plans provide for a 300-hp plant, to cost about $150,000.

Canada

NANAIMO, B. C.—Within the next few months the Nanaimo El. Lt., Pwr. & Htg. Co. expects to purchase a new boiler. The company is now extending its pole line.

VERNON, B. C.—At an election held recently the by-law authorizing extensions to the electric-lighting system, at a cost of $110,000, was caried.

VICTORIA, B. C.—The Canadian Pwr. & Land Co. has recently applied to the Dominion government for a license under the water act to divert water from the Cowichan River for hydroelectric purposes. The company contemplates building a 10,000-hp plant about 6 miles from the outlet of Cowichan Lake.

WINNIPEG, MAN.—The Winnipeg St. Ry. Co. has applied to the Manitoba Legislature for authority to erect a transmission line through the municipality of Fort Garry. The municipality asks for permission for joint use of the poles in return for use of streets by the company.

BOLTON, ONT.—Preparations are being made by the Village Council to receive hydroelectric power from the Hydro-Electric Power Commission of Ontario. The commission will be asked by the Council to make an appraisal of the plant operated by the Bolton Lt. & Ht. Co. and to submit an estimate of the cost of remodeling the same to enable it to distribute 200 hp of hydroelectric energy. The transmission line of the Hydro-Electric system will be extended from Weston, by way of Woodbridge, Pine Grove, Kleinburg and Nashville to Bolton.

BURFORD, ONT.—The ratepayers on March 9 voted in favor of the by-law authorizing the Municipal Council to enter into a contract with the Hydro-Electric Commission for Niagara power; also a by-law appropriating funds providing for the erection of a distributing station and equipment.

STRATHROY, ONT.—The Town Council has passed a by-law authorizing an issue of $25,000 in debentures to provide funds for the construction of a distributing system for hydroelectric power to be supplied by the Hydro-Electric Power Commission.

TORONTO, ONT.—Instructions have been issued by the manager of the Toronto Hydro-Electric system for the installation of street lamps on Cedarvale, King Edward, Gledhill, Coleridge and Woodbines Avenues in York Township.

WESTMINSTER, ONT.—The Township Council has forwarded a petition from the ratepayers to the Hydro-Electric Commission of Ontario asking for estimates for furnishing hydroelectric power in Westminster Township.

MONTREAL, QUE.—Contracts will soon be awarded by the Montreal & Southern Counties Ry. Co., of Montreal, for the construction of a new power house in Granby.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 27, for furnishing copper wire, electric cable, steel, anchor rods, etc. Blanks and general information relating to this circular (No. 835A) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 614 Whitney-Central Building, New Orleans; also from the United States Engineer Offices in Pittsburgh, Pa.; Boston, Mass.; Chicago, Ill., and St. Louis, Mo. Major F. C. Boggs is general purchasing officer.

New Incorporations

ONEONTA, ALA.—The Oneonta Ice, Lt. & Coal Co. has been incorporated with a capital stock of $5,000 by Pratt B. Hale, W. T. Eason and H. L. Lyman.

CHICO, CAL.—The Keno Pwr. Co. has been chartered with a capital stock of $250,000 by J. W., B. E. and G. G. Kerne.

DOVER, DEL.—The Southern Iowa Light & Ry. Co. has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $500,000.

METTER, GA.—The Metter Co-operative Lt. & Pwr. Co. has been chartered with a capital stock of $20,000. The incorporators are J. R. Dixon, W. J. Brown, B. G. Bowen and others.

GALT, MO.—The Galt Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by A. D. Miller, D. H. Clark and D. N. Jordan.

HAYTI, MO.—The Hayti Lt. Co. has been incorporated with a capital stock of $10,000 by Edward Bishop, L. C. Averill and E. F. Sharp.

TONOPAH, NEV.—The Colorado River Hydro-Electric Co. has been incorporated with a capital stock of $5,000,000 by Henry C. Schmidt, W. R. Williams and William Forman. The company recently secured water rights on the Colorado River near the Nevada line.

RICHMOND, VA.—The James River & Kanawha Pwr. Co. has been organized to construct a hydroelectric power plant.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 10, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

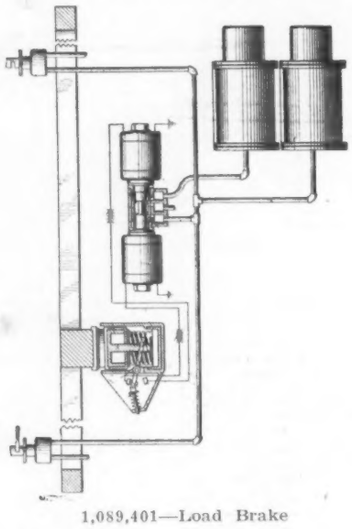
1,089,394. CALL-RECORDING SYSTEM FOR TELEPHONE EXCHANGES; E. E. Clement, Washington, D. C. App. filed Nov. 21, 1905. Records number of calling line and indicates whether the line called has answered or not.

1,089,401. LOAD BRAKE; E. H. Dewson, New York, N. Y. App. filed May 28, 1913. Electrically controlled means is governed by the load on the car to regulate the braking power.

1,089,404. FIRE-ALARM SIGNAL BOX FOR AUTOMATIC TELEPHONE SYSTEMS; J. Erickson, Chicago, Ill. App. filed Dec. 28, 1911. Central-office switching mechanism is automatically controlled to establish connection between subscriber's circuit and fire-alarm headquarters.

1,089,414. AUTOMATIC TROLLEY-POLE CONTROLLER; M. J. Jolliffe, New Haven, Conn. App. filed April 10, 1911. Power-circuit magnet operates valve controlling flow of compressed air to retrieving cylinder.

1,089,415. DEVICE FOR SUPPORTING TROLLEY WIRES; C. De Kandó, Budapest, Austria-



1,089,401—Load Brake

Hungary. App. filed March 26, 1907. Permits vertical movement but prevents lateral movement.

1,089,426. TRANSLATING AND REGISTERING APPARATUS; E. C. Molina, East Orange, N. J. App. filed May 15, 1911. Semi-automatic telephone system.

1,089,461. JUMP-SPARK IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; M. B. Crist, Pittsburgh, Pa. App. filed Feb. 15, 1906. Transformer with special means for insulating and cooling the parts.

1,089,478. EXPLOSION MOTOR; A. T. Kasley, Swissvale, Pa. App. filed Sept. 1, 1909. Changes ratio of air and gas which make up the explosive mixture in accordance with the variations in the quality of the gas.

1,089,490. ELECTROLIER FITTING; C. Messick, Hackensack, N. J. App. filed Oct. 24, 1913. Pull-switch attachment for the center of an ordinary multiple-arm electrolier.

1,089,534. DIFFERENTIAL MICROPHONE REPEATER; J. J. Comer, Chicago, Ill. App. filed Feb. 27, 1911. Operative connection or stem passes through only one wall of the springy or resilient member.

1,089,540. LAMP-IGNITION DEVICE; L. M. Dull, Los Angeles, Cal. App. filed Oct. 24, 1912. Circuit-making controlling valve for turning on flow and igniting automobile gas lamps.

1,089,549. STORAGE-BATTERY SYSTEM; E. A. Halbleib, Rochester, N. Y. App. filed Jan. 16, 1913. For automobiles particularly.

1,089,564. CIRCUIT CONTROLLER; S. P. Hull, Yonkers, N. Y. App. filed April 3, 1913. Used in connection with tappet bars of interlocking machines of railway switches and signals.

1,089,589. ELECTRIC INDICATOR; C. Schneck and J. M. Graham, Chicago, Ill. App. filed May 12, 1911. Annunciator in which the drop, while readily shiftable, cannot easily be jarred from its set position.

1,089,597. SQUIRREL ROTOR; F. W. Stefater, Louisville, Ky. App. filed April 14, 1913. Construction for locking the bars and end rings together.

1,089,642. SUPPORT FOR ELECTRIC CONDUCTORS; G. Honold, Stuttgart, Germany. App. filed Sept. 21, 1911. Insulating carrying disks are threaded on a supporting rod and are provided with openings receiving the conductors of an ignition system.

1,089,658. ELECTRICALLY DRIVEN PLANING MACHINE; G. E. Mason, Toronto, Canada. App. filed Sept. 6, 1910. Employs auxiliary generator operated by motor fed from the mains, whose field is controlled by switchgear operated by the machine, said generator controlling and reversing armature current of the driving motor.

1,089,659. SYSTEM OF CONTROL; H. Maxwell, Schenectady, N. Y. App. filed June 13, 1908. Alternating-current induction motor automatically changed to a synchronous motor when running under light loads.

1,089,673. TELEPHONE CUT-OFF; R. J. Robinson, Romulus, Okla. App. filed June 20, 1913. For rural lines.

1,089,684. WIRE CABLE; J. B. Stone, Fresno, Cal. App. filed Oct. 9, 1912. Made up of a series of thin, flat strips twisted into auger form.

1,089,700. CURRENT COLLECTOR AND PROCESS OF MAKING THE SAME; E. G. Gilson, Schenectady, N. Y. App. filed Nov. 17, 1911. Embeds unbraided end of stranded conductor in finely divided brush material containing oxide, compressed and fired in a vacuum.

1,089,712. AUTOMATIC REMINDER; H. E. M. Kensit, Ottawa, Canada. App. filed Dec. 20, 1912. Operates by timepiece to give visual and audible signal at any predetermined time.

1,089,749. ELECTRIC LAMP; H. A. Douglas, Chicago, Ill. App. filed April 11, 1912. Includes spring-pressed cord terminals.

1,089,757. TUNGSTEN MANUFACTURE; T. W. Frech, Jr., Cleveland, Ohio. App. filed Oct. 9, 1912. Heats tungstic oxide under oxidizing conditions with a compound of thorium.

1,089,759. FILAMENT MOUNTING; E. S. Gardner, Acquacknanonck, N. J. App. filed Dec. 27, 1910. Continuous filament looped back and forth over relatively short and long outstanding filament-carrying arms.

1,089,771. BINDING POST; C. F. Kettering, Dayton, Ohio. App. filed Nov. 14, 1910. Resilient clamps.

1,089,778. ELECTRIC TRANSPORTATION SYSTEM; C. B. and J. F. McLeer, Brooklyn, N. Y. App. filed May 26, 1911. Co-operating magnetic motor elements on casing and car propel car through the casing.

1,089,783. ELECTRIC MOTOR DRIVE; K. A. Pauly, Schenectady, N. Y. App. filed Aug. 29, 1913. For universal reversing rolling mills.

1,089,786. METHOD OF WORKING REFRACTORY METALS; M. Von Pirani, Berlin, Germany. App. filed Nov. 23, 1912. Electrically locally heats cracked refractory metal in inert atmosphere until cracked portions automatically reunite and then re-rolls.

1,089,787. INTERMEDIATE SUPPORT FOR BOND-WIRES AND NUT-LOCKS; W. M. Post, Elizabeth, N. J. App. filed March 24, 1909. Spring washer nut-lock with curved-wire retaining tongue.

1,089,814. TESTING SYSTEM AND MECHANISM FOR ELECTRICAL CIRCUITS; C. E. Beach and H. W. Doughty, Binghamton, N. Y. App. filed April 9, 1912. Contemplates use of two main switch mechanisms.

1,089,815. ALTERNATING-CURRENT MOTOR; A. C. and T. R. Bell, Westfield, N. J. App. filed July 14, 1910. Improved short-circuiting means for commutator of alternating-current motor.

1,089,820. CONTROL OF ELECTRICALLY OPERATED SWITCHES; E. R. Carichoff, New York, N. Y. App. filed Aug. 12, 1910. Successively operating contactors.

1,089,825. TELEPHONE TRANSMISSION CIRCUIT; H. C. Egerton, Passaic, N. J. App. filed July 18, 1912. Prevents interference of one receiver with the other during a period of communication over one of the circuits.

1,089,850. SWITCH CONTROL; S. A. McConnell and B. Erickson, Portland, Ore. App. filed Aug. 26, 1912. Prevents accidental engagement of lever of knife switch with binding posts.

1,089,884. MANIFOLD HEATER; F. A. Vollbrecht, Detroit, Mich. App. filed Dec. 26, 1912. Small heater mounted inside intake pipe.

1,089,886. ELECTRIC APPARATUS FOR DRIVING CLOCKS OR SIMILAR MECHANISM; H. E. Warren, Ashland, Mass. App. filed Dec. 23, 1909. Pendulum given periodic added impulses while in oscillation.

1,089,907. ELECTRICAL CONTACT; W. D. Coolidge, Schenectady, N. Y. App. filed March 20, 1912. Make-and-break contacts of metallic tungsten usually in the wrought or malleable form.

1,089,919. ALTERNATING-CURRENT CONTROLLING APPARATUS; E. L. Gale, Sr. Yonkers, N. Y. App. filed Dec. 18, 1905. For starting alternating-current motors.

1,089,920. CURRENT-CONTROLLING APPARATUS; E. L. Gale, Sr., Yonkers, N. Y. App. filed June 11, 1907. Motor starter with means for absorbing the field discharge.

1,089,921. ELECTRICAL CONTROLLING APPARATUS; E. L. Gale, Sr., Yonkers, N. Y. App. filed May 2, 1912. Has means insuring demagnetization of an alternating-current brake magnet.

1,089,937. ELECTRIC ELEVATOR; C. B. Manville, Yonkers, N. Y. App. filed May 16, 1912. Prevents elevator being operated by other than the proper apparatus designed for that purpose.

1,089,950. DIRECTION-INDICATING SIGNAL; J. J. O'Connell, Rochester, N. Y. App. filed May 21, 1913. Electrically operated from driver's seat to indicate contemplated movements to one following.

1,089,951. PROCESS AND HIGH-PRESSURE FURNACE FOR THE DIRECT PRODUCTION OF IRON AND STEEL; C. Otto, Dresden, Germany. App. filed Nov. 1, 1911. Powerful electric current used to remove all protoxide remnants.

1,089,957. TROLLEY FOR TRACKLESS VEHICLES; W. B. Potter, Schenectady, N. Y. App. filed July 28, 1909. Contact head carried on ball socket.

1,089,968. TROLLEY ATTACHMENT; F. A. Schmedinghoff, Kansas City, Mo. App. filed April 29, 1913. Non-conducting wire-engaging guards at opposite sides of the trolley harp.

1,089,993. MAGNETIC SEPARATOR; G. Ullrich, Magdeburg, Germany. App. filed March 14, 1913. Magnet poles arranged about a vertical shaft beneath a counter pole consisting of co-axially disposed downwardly tapered rings.

1,090,048. CONTINUOUS-CURRENT GENERATOR; K. Greuner, Essen-on-the-Ruhr, Germany. App. filed May 15, 1911. Embodying so-called "Leonard connection."

1,090,053. TELEPHONE-LOCKING DEVICE; J. W. Harvey, Sunset, Tex. App. filed April 18, 1913. Link and chain locking connection between receiver hook and instrument base.

1,090,107. ELECTRIC FURNACE; S. Peacock, Chicago, Ill. App. filed Sept. 7, 1912. For producing carbo-nitrides.

1,090,109. MEANS FOR STARTING MOTOR ROAD VEHICLES; F. R. Simms, London, Eng. App. filed July 14, 1913. Magneto electric machine with separate ignition and lighting armatures, latter of which serves for starter motor.

1,090,111. MANUFACTURE OF ELECTRIC FILAMENTS; C. F. A. von Welsbach, Vienna, Austria-Hungary. App. filed Nov. 25, 1903. From osmium and highly refractory oxides.